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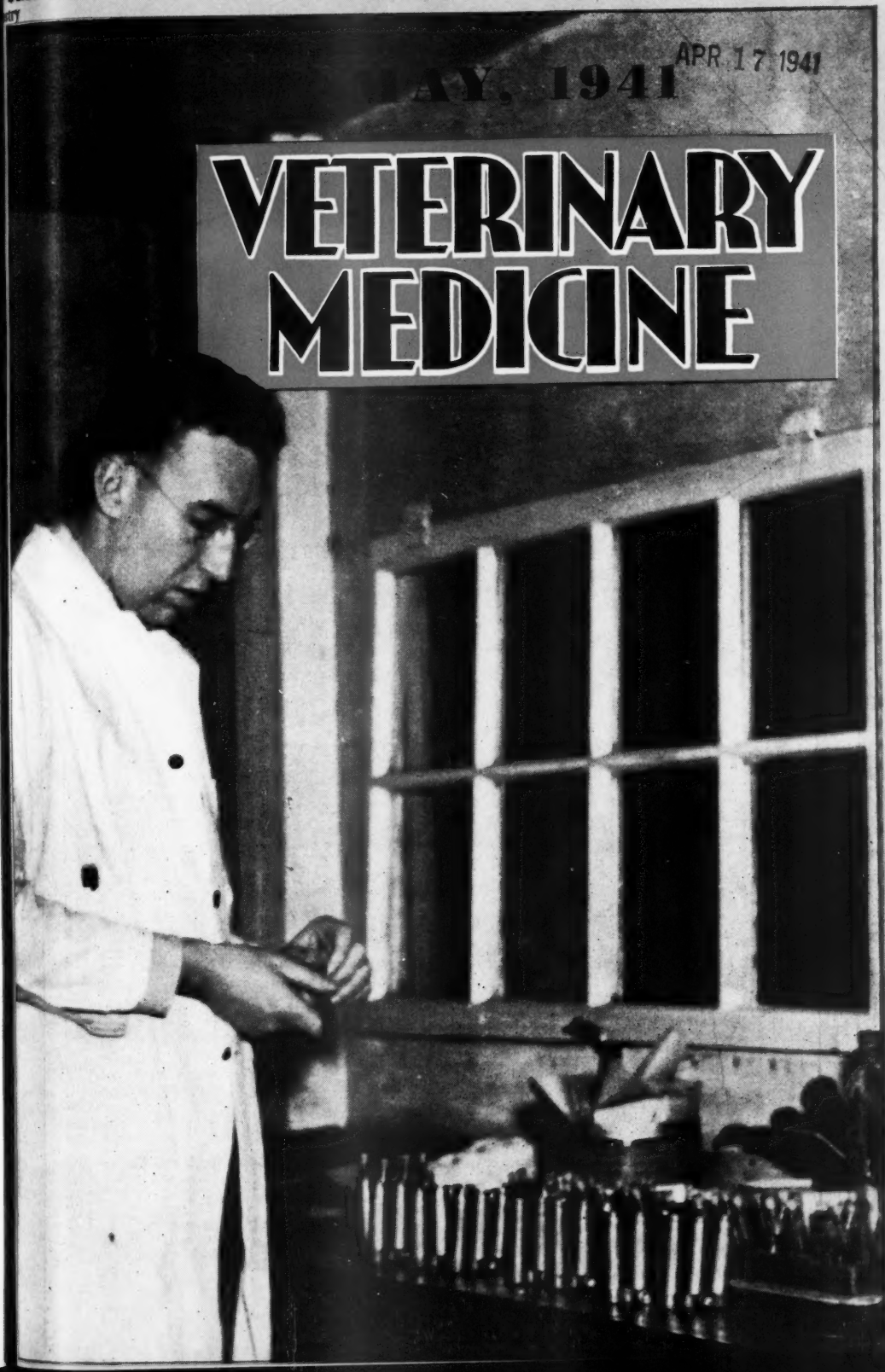

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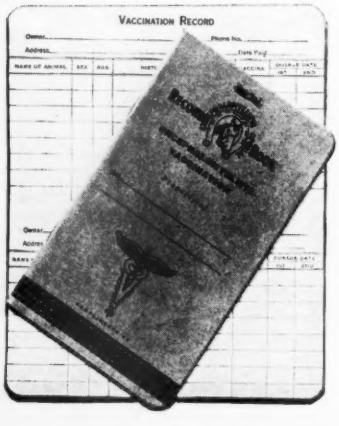

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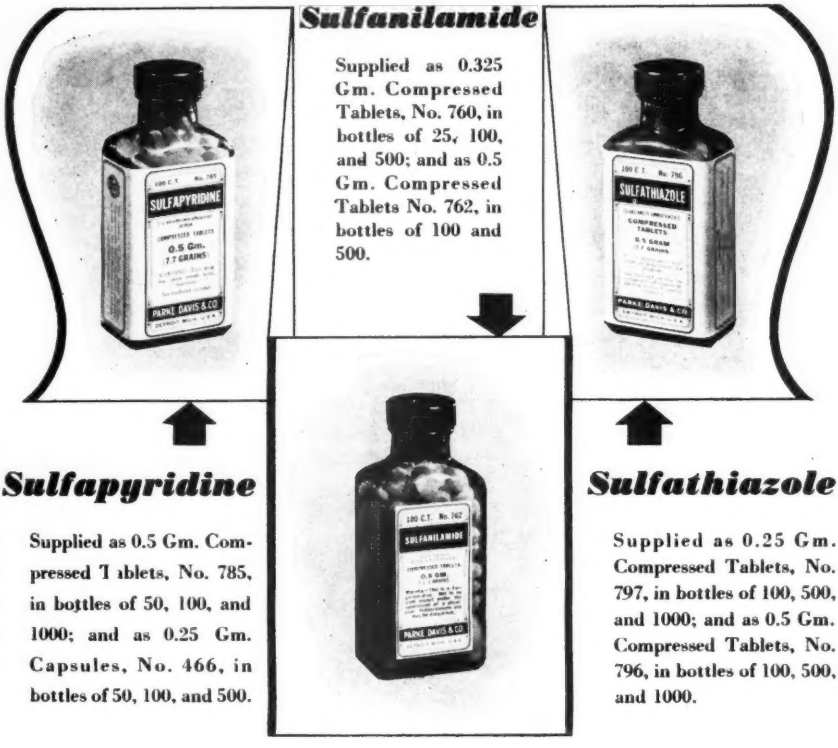

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CONTENTS

Veterinary Progress, Policies and Comments 229-243

War Experience Led to Improved Antiseptics, 230; Extension of Medical Service, 230; Fruits of Clinical Observation, 230; The Living and Non-Living Inseparable, 230; Veterinary Faculty, Texas A. & M. College, 231; Scholarships Available for Veterinarians, 231; Labeling Requirements of U. S. Meat Inspection, 232; Veterinary Skin Lotion, 232; Forbidden Drugs, 232; Thorough Stripping of Little Value in Mammary Disease, 232; Staff of the *M. S. C. Veterinarian*, 233; Culmination of Veterinary Research, 234; Equine Nutrition Neglected, 235; Liver Abscesses in Beef Cattle, 235; "Hard to Settle" Cows, 236; Quarantine History, 237; Factors in Anthelmintic Treatment, 238; Vesicular Exanthema, 240; The Newspapers Say—, 242.

Trembles Produced by Toxic Butter—James F. Couch 244

Recent Materia Medica. X. Pituitary Hormones—Victor Lewitus 246

The Removal of Cystic Calculi—T. A. Sigler 254

Hemorrhagic Septicemia?—W. M. Burson 257

Complications Following Nail Prick—Bernard Busby 258

Libido in a Castrate Dog—J. George Feinberg and R. M. Codd 259

Fibro-Adenoma with Cellular Infiltration in a Dog—Virgil R. Kelley 259

Feline Gastric Ulcers—George R. Armstrong 260

Trichomoniasis in a Puppy—K. L. Bruce 261

Vitamin B Therapy in Leucoma—Rodney I. Port 261

A Holiday Episode—E. T. Baker 262

The Control of Avian Coccidiosis—Cliff D. Carpenter 263

A Practitioner's Experience with Milk Fever—S. L. Stewart 266

A Few Timely Tips on Swine Practice—John B. Bryant 270

A New Treatment for Internal Parasites of Sheep—N. J. Eder 272

Pregnancy Disease in a Ewe—Charles C. Smith 273

Epsom Salt Poisoning in Cows—R. H. Smith 273

Abstracts and Book Reviews 274-280

THE FRONT COVER

A view in the pathological laboratory in the Division of Veterinary Science, Michigan State College, showing J. H. Steele, senior veterinary student, as he stirs and centrifuges blood samples for the Brucellosis agglutination test in order to separate the blood serum, containing the antibodies, from the red cells. This procedure saves time and gives more accurate results, especially in the slow test, inasmuch as the presence of erythrocytes may either interfere in the interpretation of the test or step up the sensitization factor. About 400 blood samples are received daily from practicing veterinarians for the routine agglutination test, which is done by the rapid or plate method. The slow test is used for animals going on interstate shipments to comply with the regulations of some other states. Three veterinarians and one graduate student are employed part-time to run the tests and prepare antigen, while several veterinary students take care of washing, sterilization and the preparation of media.

Mr. Steele has been student representative of VETERINARY MEDICINE at the Michigan State College for two years, and each year has obtained subscriptions to VETERINARY MEDICINE from a larger percentage of his fellow students than has the student representative in any other college.

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American soldiers stationed in Panama, Puerto Rico and the Caribbean bases are now being vaccinated against yellow fever.

Twenty-five years ago cattle producers received 66 cents of every dollar the consumer paid for beef. Now they get about 42 cents. Hog producers 25 years ago received 82 cents of the consumer's pork dollar. The reason? Well, there are several factors involved, but excess live stock markets and excess meat distributing facilities are among the most conspicuous.

Since the fundamental studies of Fahraeus in 1917, the erythrocyte sedimentation test has become a very commonly used tool of the physician. Despite the many possibilities of error in execution and interpretation, its comparative value has not diminished.

In 1916, C. J. Marshall, reporting a visit with Sir Stewart Stockman of the Department of Agriculture and Fisheries (British) wrote: "He believes vaccination against contagious abortion is useful; gives very large doses and only to young heifers before they are bred." That was 25 years ago. Calfhood vaccination isn't so new—except to some veterinarians.

Three factors have been largely responsible for the magnificent achievements of surgery in the last three quarters of a century: the discovery of anesthesia, the development of the antiseptic and later aseptic methods of operative technique, and a proper appreciation of the methods of controlling hemorrhage; each in turn has contributed to make possible the wonders and miracles of modern operative surgery.

The newest member of the vitamin B complex to be identified and given a name is p-aminobenzoic acid. This vitamin is needed by chicks and bacteria for growth. It is also the vitamin that prevents greying in black and piebald rats.

A new method of detecting and identifying viruses, toxins, and other ultramicroscopic substances by the changes of iridescent colors reflected from very thin films of solutions of the material being examined, has been patented. The patent is assigned to General Electric Research Laboratory.

A new measles vaccine has been developed at the Squibb Institute for Medical Research which gives great promise and is receiving an extensive trial. Virus for the production of the new vaccine is grown on chick embryos. It is not yet generally available.

One of the strange occurrences in the history of bacteriology was the failure over a period of more than 20 years to recognize the relationship between two organisms so similar that the resources of bacteriologists have been taxed to the utmost to find distinguishing characteristics. The causal organism of Malta fever in man was isolated by Bruce in 1887; he called it *Micrococcus melitensis*. In 1897 Bang in Denmark discovered the cause of infectious abortion of cattle, naming it *Bacillus abortus*. It was not until 1917 that Alice Evans, at the suggestion of Adolph Eichhorn, then Chief of the Pathological Division of the federal Bureau of Animal Industry, made a comparative study of the two organisms and found that they were indistinguishable except by agglutinin absorption tests. The genus name Brucella was suggested in 1920.

War is bad. No question about that, but as a destroyer of human life it is something of a piker. Smallpox took the lives of 60 million persons in Europe during the 18th century, and maimed or marred most of the remainder of the population.

War Experience Led to Improved Antiseptics

It is estimated that more than 200 different antiseptics were used during World War I by the medical departments of the various armies; an indication of the inadequacy of one antiseptic to meet all requirements.

Extension of Medical Service

January 1, 1941, there were 66 approved group hospital service plans in operation, providing hospital care for 6,000,000 persons, as compared with 60,000 on January 1, 1935, and 600,000 on January 1, 1937. It is estimated that during 1941 more than $35,000,000 will be paid to hospitals through these service groups.

Diabetes

"The flesh and bones run together into urine . . . the integuments of the abdomen become wrinkled, and the whole body wastes away. The secretion of urine becomes more copious and the thirst increases more and more. The disease was called diabetes, as though it were a syphon, because it converts the human body into a pipe for the transflux of liquid humors."—*Aretaeus*, A. D. 30-90.

Dr. Withering practised medicine in Shropshire, England, and it was there that he made his epochal studies on the foxglove. The plant had been known for centuries, but as a heart tonic, clinically evaluated, the work of Withering made it available to the medical profession in 1875. A century and a half have elapsed since then. During most of those intervening years physicians and pharmacists have been harassed by the vexing problem of producing digitalis in more stable forms.

Many of our modern drugs are the active principles of plants well known to the ancients. None is more interesting than ephedrine. The Chinese used various species of *Ephedra* five thousand years B.C.

The labors of bacteriologists between 1840 and 1890 so clearly established the fact that microscopic animals and plants are the cause of infectious diseases that it became heresy to hold that such diseases might be produced in any other way. The names of Dujardin, Davaine, Ferdinand, Cohn, Koch and Pasteur, stand out in the consciousness of everyone as being associated with the proof that microorganisms are the cause of infectious maladies.—*Thos. M. Rivers.*

Fruits of Clinical Observation

Jenner's keen observations and careful reasoning transformed a tradition and hazy belief into an established fact. The original observation from which Jenner worked was that dairymaids and others who had been infected with cowpox were thereafter spared when a smallpox epidemic appeared in the locality. He proved, through logical and scientific methods, that inoculation with cowpox protected against smallpox.

Pasteur expanded Jenner's fact into a great basic principle: susceptibility to disease can be converted into resistance.

The Living and Non-Living Inseparable

Some 2,300 years ago Aristotle is credited with saying that in nature the transition from the animate to the inanimate is so gradual that the boundary line between them is doubtful, and perhaps nonex stent. Spinoza, in the 17th century, expressed the belief that life exists in differing degrees dependng upon the organization in all matter. Iwanowski in 1904 observed without recognizing crystallized tobacco mosaic virus. Stanley, by crystallizing the same virus and infecting tobacco and other plants with the crystal form in 1935, set all biologists again to discussing the borderline between life and death and whether viruses are living organisms or inanimate chemical combinations—nucleoproteins.

VETERINARY MEMBERS, FACULTY OF SCHOOL OF VETERINARY MEDICINE, TEXAS A. & M. COLLEGE

First Row (left to right): H. Louis Rubin, Veterinary Anatomy; Fred P. Jaggi, Jr., Veterinary Hygiene; Russell L. Mundhenk, Veterinary Anatomy; August A. Lenert, Veterinary Medicine, Surgery and Clinics; Ross P. Marsteller, Dean, School of Veterinary Medicine, Veterinary Medicine, Surgery and Clinics; R. Clark Dunn, Veterinary Pathology and Bacteriology; Patton W. Burns, Veterinary Physiology and Pharmacology; Stephen W. Lange, Veterinary Anatomy; George C. Rich, Veterinary Medicine, Surgery and Clinics.

Second Row (left to right): John L. West, Division of Veterinary Science; Horatio L. Van Volkenberg, Veterinary Parasitology; W. William Armistead, Veterinary Medicine, Surgery and Clinics; John H. Milliff, Veterinary Pathology and Bacteriology; Harold E. Redmond, Veterinary Medicine, Surgery and Clinics; Henry J. Kuzewski, Veterinary Physiology and Pharmacology; R. D. Turk, Division of Veterinary Science; Terry S. Ozier, Veterinary Pathology and Bacteriology.

The following veterinary faculty members were not present when this photograph was taken: B. L. Warwick, Division of Range Animal Husbandry; Hubert Schmidt, Chief, Division of Veterinary Science; I. B. Boughton, Division of Veterinary Science; W. T. Hardy, Division of Veterinary Science; J. J. Reid, Division of Veterinary Science; P. L. Piercy, Division of Veterinary Science; C. A. Woodhouse, Division of Veterinary Science; George T. Edds, Veterinary Physiology and Pharmacology.

Chemical Composition of the Human Body

Element	*Percentage*
Oxygen	65.0
Carbon	18.0
Hydrogen	10.0
Nitrogen	3.0
Calcium	1.5
Phosphorus	1.0
Potassium	0.35
Sulphur	0.25
Sodium	0.15
Chlorine	0.15
Magnesium	0.05
Iron	0.004
Manganese	0.0003
Iodine	0.00004
Copper	*
Zinc	*
Silicon	*
Aluminum	*
Fluorine	*

* Amount not determined, but very small.

Scholarships Available for Veterinarians

Pursuant to congressional authorization the Surgeon General of the U. S. Public Health Service has announced that fellowships in the sciences related to public health are available to qualified applicants from the Latin American Republics. Among other requirements, applicants must have successfully completed academic training in "medicine, dentistry, veterinary medicine, pharmacy, sanitary engineering, nursing, vital statistics, or bacteriology." Inquiries should be addressed to the Pan American Sanitary Bureau, Washington, D. C. (E. U. de A.).

Other scholarships are available, through the Division of Cultural Relations of the State Department, to Latin-American veterinarians who meet the other requirements.

Labeling Requirements of U. S. Meat Inspection Modified

The marking and labeling requirements for meat and meat food products prepared under Federal meat inspection have been modified by an amendment to the meat-inspection regulations. The amendment—designated as Amendment 15 to B.A.I. Order 211 (Revised)—becomes effective October 1, 1941.

One of the important features of the new amendment is to require that a meat or meat food product prepared from two or more ingredients shall bear a label showing a list of ingredients, placed in the order of their predominance.

Another requirement is that the covering of a meat food, such as a cellophane wrapper, shall not as regards coloring or printed design give the purchaser a false impression of the leanness or quality of the product enclosed.

The new requirements apply to labels on imported as well as domestic meat and meat food products.

* * * *

Veterinary Skin Lotion

Several years ago Dr. S. L. Hilton, Washington, D. C., working in conjunction with a veterinarian, developed a mixture of resorcin, salicylic acid, menthol, and methyl salicylate for the treatment of various skin conditions of the eczema type in animals. Its use among veterinarians has grown until today Doctor Hilton makes it in gallon quantities. He has suggested it for inclusion in the National Formulary, made according to the following formula:

Alcohol	50cc
Glycerin	200cc
Tragacanth (ribbons)	8gm
Menthol	2gm
Methyl Salicylate	2cc
Salicylic Acid	10gm
Resorcin	20gm
Distilled Water, *q.s.*	1000cc

Add 200cc of water to the tragacanth and allow to stand for 48 hours, stirring occasionally. Dissolve the menthol and salicylic acid in the alcohol. Dissolve the resorcin in 200cc of water. To the tragacanth jelly add the glycerin, mix thoroughly, add the alcoholic solution and after mixing, add the solution of resorcin and a sufficient quantity of water to make 1000cc. After mixing, pass through a homogenizer.—*Jnl. A. Ph. A.*

Forbidden Drugs

Among the drugs that should not be dispensed over the counter for lay use and which are listed as dangerous by the Food and Drugs Administration are:—

Aconite	Santonin
Aspidium (male fern)	Sulfanilamide
	Sulfapyridine
Carbon tetrachloride	Sulfathiazine
Chenopodium (oil)	Tetrachlorethylene
Digitalis	Thymol
Emetine	

The list is much longer but these are the ones commonly prescribed for animals.

* * * *

Thorough Stripping of Little Value in Mammary Disease

The modern explanation of many important phenomena of lactation has made untenable a number of old theories about the causes of mammary disease. The first important fact explained is that milk secretion is definitely a continuous process. Before the work of Swett and his associates in 1932 the incorrect theory that the secretion of milk took place at the time of milking was popular. The milk which is, however, secreted uninterruptedly, is stored in the complicated system of ducts and cisterns in the udder. Espe, in his very excellent monograph on the secretion of milk, states that the rate of secretion is most rapid immediately after milking, when intramammary pressure is at a minimum. This means that within a very short period after milking, milk would once more have accumulated in the teat and lactiferous sinuses. Finally, even though a cow has been thoroughly milked, only about 80 to 85% of the milk present in the udder at the time of milking is removed.

These facts make one doubt that thorough stripping is as essential to the control of mastitis as it has been claimed to be. Woodward describes an experiment in which he investigated the effect of incomplete milking in relation to milk production and udder troubles, and he concluded that leaving a small quantity of milk in the udder had no effect on milk production, nor did it cause mastitis. Very little work has been done to determine the influence of incomplete or other systems of milking on the udder, and the problem needs more thorough investigation.—*H. P. Steyn*, in *Jnl. So. Afr. V. M. A.*

STAFF OF THE *M. S. C. VETERINARIAN*

Here are the staff members of the new veterinary student publication at Michigan State College. Seated (left to right): James H. Steele; L. A. Fahlund, Editor; Paul Brown, Business Manager; Steve Kelly; Ronny Gillet; Irving Roberts; E. J. Van Tilborg, Editor Small Animal Section.

Standing (left to right): Rommy Steensma; Arthur Wolf; Dr. C. A. Cairy, Faculty Adviser; Don Morrill, Assistant Editor; Eugene Eads; Paul Gambrel; Jack Fries; John Kortenber; Dean Fluharty.

Mr. Steensma is no longer in school, having joined the Canadian contingent of the Free Dutch Army.

The morality of the two groups (of chickens) during both experiments (on feeding pelleted and unpelleted mash) was not appreciably different.—*Poultry Science.*

* * * *

There are 765 establishments in the United States engaged in the wholesale dressing and packing of poultry. The dollar volume of this industry in 1936 totaled $138,318,081.

* * * *

Pigeon pox virus must always be applied by the follicle method, never by the "stick" method. With fowl pox virus the "stick" method should be used, as it is less apt to be attended by serious results. In either case, egg-propagated virus is preferable to that propagated on birds.

* * * *

The production (and consumption) of turkeys doubled in the last decade, increasing from 16 to 32 million birds annually. The increased consumption is credited to the merchandizing activities of chain stores, which in 1928 began advertising turkeys at other than the Fall holidays and soon went into year-around marketing.

According to Bryan, 98 to 99% of all mastitis in cows is streptococcic mastitis. Mastitis on the average reduces the milk production of the infected individual by 25% and the quality of the milk by 50%. Of Michigan herds, 86% are infected and 26% of Michigan cows are infected. Mastitis is one of the major factors in herd wastage.

* * * *

During the Revolutionary War, Gen. Washington was impressed with the need of the army for officers with a knowledge of engineering. As a result of his recommendation, the U. S. Military Academy at West Point was established (1801) to educate engineers for the Army. In 1812 the number of cadets was increased from 20 to 250 and in 1831 the course of instruction was changed from purely engineering to one designed to educate officers of the line also. Graduates of the institution were looked upon with contempt by other officers till about the close of the Mexican War. At that time they came into ascendancy in the Army. In the Civil War a very large proportion of the General officers were engineers—graduates of the military academy.

Effective Immunization Against Tetanus
A Culmination of Veterinary Research

The work of a French veterinarian is largely responsible for placing tetanus in the category of those diseases which can be completely eliminated at will in both human beings and animals.

Tetanus antitoxin has been known for a half-century, and has played an important rôle in the prophylaxis and treatment of the disease. If administered early enough in large doses, it is very effective; however, it is of little or no value in small doses and is progressively less effective in advanced stages of the disease. The control of tetanus by antitoxin therefore depends upon the immediate administration of massive doses; these are not always available when needed and, in the case of animals, the cost is often prohibitive.

In 1924 Gaston Ramon, now Director of the Pasteur Institute, and his associates developed a method of producing an active immunity to tetanus by the use of toxoid (toxin treated with formaldehyde so that it loses its toxic qualities while retaining the ability to stimulate the production of antibodies when injected into the animal body). Later workers have carried out extensive investigations on the refinement of the substance to be used, the technique of administration, the degree of immunity and its duration, and other problems. It has been found that the most effective preparation of toxoid is obtained by using formaldehyde and heat, as Ramon originally proposed, plus further refinement by precipitation with alum and washing.

This toxoid, when given to man or animals in two small doses two to four weeks apart, produces a high degree of resistance to tetanus in several months. This immunity can be further enormously stimulated by a third or "boosting" dose given three or more months later. The immunity thus obtained has been shown to be of fairly long duration, and may even be lifelong, although this point will not be fully established until a longer period of time has elapsed.

Since full immunity is not developed for several months, toxoid is useful only as a preventive measure, and is of no value once infection has occurred. It is therefore advisable to begin toxoid injections well in advance of any likelihood of exposure.

This is a reproduction of a bronze plaque presented to Gaston Ramon on the occasion of the dedication of the Maison des Vétérinaires, Paris, January 16, 1936, in recognition of his outstanding contributions in the domains of prophylaxis in animal production and public health. Ramon was at that time under-director of the Pasteur Institute. His achievements and personal abilities have since received further recognition in his appointment as Director of the Institute

The advantages of this method of immunization for military personnel are obvious, and it has already had a wide trial in the armies of the world, for both men and animals. No cases of tetanus have been known to occur in those inoculated with toxoid. In World War I every soldier wounded on the battlefield was given a dose of tetanus antitoxin as a part of his first-aid treatment. Previous immunization with tetanus toxoid has made this unnecessary in the present war in Europe.

Although the hazards of military life render immunization of the combat forces more urgent than that of any other group, the incidence of tetanus in the civil population is sufficiently high to warrant its use here also. Many pediatricians are already recom-

mending the combined use of diphtheria and tetanus toxoids for children in order to produce an active protection against both diseases. This is the more desirable in that there have been reported but few adverse reactions to inoculation with tetanus toxoid, and these few have been mild.

For horses and mules, use of the toxoid for immunization will probably be restricted to those in the military service, where the hazard of exposure is great, and those whose owners wish to protect them because of their unusual value or for sentimental reasons.

Pasturage is not sufficiently concentrated to support a heavy production of milk. Cows graze about 150 pounds per day on good pasture. This is equivalent to a dry matter intake of 30 to 35 pounds, which will support a daily production of about 1¼ pounds of butter fat—30 to 40 pounds of milk, depending upon its richness. Supplemental grain feeding is therefore necessary for high producing cows.

Good pasture provides the best feed there is for dairy cows, and besides is usually cheaper than harvested crops. Good pasture herbage contains all the factors required for perfect nutrition. If cows are permitted to graze such herbage, any nutritive elements that may have become depleted through the feeding of poor-quality roughage during the winter will be automatically restored in their bodies. Pasturage has always been and still is a life-saver for dairy cattle.

Equine Nutrition Neglected

The horse is probably the most neglected animal from the standpoint of experimental evidence on nutrition . . . Mineral nutrition especially is important in horse production. We have no other class of animal in which size and quality of bone is so important, yet we have very little information. I believe that one of the most important problems from the farmers' standpoint is in this field. Horsemen are continually making inquiry as to how they can produce horses with the quality of bone that is found in horses produced in our better bluegrass states.—*Bentley*.

Milk in summer may contain twice as much vitamin D potency as winter milk.—*Sci. News Letter*.

When sows farrow in the spring, the later stage of pregnancy, during which the rate of utilization of calcium and phosphorus is especially high, coincides with a period when there is likely to be the greatest shortage of vitamin D.

Among cows which dropped their calves during January, February, March and April, the percentage which developed milk fever was much higher than among those which calved during the other months of the year.—*Vitamin D Digest*.

In the past, irradiated milk has been standardized to a vitamin D potency of 135 U.S.P. units per quart. New irradiation equipment makes possible the irradiation of 7000 pounds of milk per hour to a vitamin D potency of 400 U.S.P. units per quart.

Liver Abscesses in Beef Cattle

Fifty-five million pounds of beef livers were condemned in federally inspected abattoirs from 1935 to 1940. About two-thirds of the condemnations were due to abscesses.

Perhaps it was instinct that influenced the aborigines to select liver, stomach and bone marrow as the choicest parts of the kill, but today the popularity of liver as a food and as a medicinal substance is influenced by more scientific reasoning. Treatment of those patients who must utilize the antipernicious anemia principle of liver has been greatly simplified by development of potent liver extracts. But whether liver be taken as an extract or as a meat market product, the prevalence of liver abscesses in beef cattle is responsible for a large economic loss and a public health loss of unknown proportions. Research to speed the discovery of the cause of liver abscesses and the development of a preventative is much needed. Clinical observation also might contribute materially to the solution of these problems if it were utilized. Both veterinary inspectors and veterinary practitioners have the opportunity to aid in the solution of the problem by recording their observations.

"Hard to Settle" Cows Respond to Vitamin C Injections

Injections of ascorbic acid, the pure form of vitamin C, often overcome breeding troubles in cows, according to recent work by Paul Phillips, H. A. Lardy, P. D. Boyer and George Werner.

Of 25 "hard to settle" cows treated, about 60% became pregnant on the first insemination after being given vitamin C. Before treatment, all these animals had failed to conceive repeatedly. One of them, in fact, had come into heat regularly every 21 days for 10 heat periods, in seven of which she was bred one or more times without success.

The cows treated in this work represent, it is believed, a fairly good cross-section of "hard to settle" animals. Some of them had physical abnormalities which could not be expected to yield to vitamin C injections. Those with cystic ovaries, for example, were not helped by the vitamin. This illustrates that vitamin C therapy is not a cureall for breeding troubles, but only helps where the difficulty actually is caused by lack of vitamin C.

Phillips and his associates became interested in the possible relationship of vitamin C to the fertility of cows after they learned this vitamin often cures sterility in bulls. When they analyzed the blood plasma of five cows which had been bred from three to seven times without conceiving, and compared these data with records on good breeders, they found indications that low vitamin C content is associated with breeding difficulties. Another finding was that during the heat period the vitamin C of the blood plasma usually rises as much as 75% or more in good breeders, but may not rise at all in "hard to settle" cows.

Work with animals from several farm herds, as well as with University animals, indicated there are breed and sex differences in the vitamin C level. In general, Guernseys need somewhat higher vitamin C concentrations for normal breeding performance than do Holsteins, and cows apparently must have a higher level than bulls.

This investigation of vitamin C therapy for cattle has not been carried on long enough, nor with sufficient numbers of cattle, to determine precisely what its value and limitations may be, but at present it looks extremely promising.

For farmers who have either bulls or cows making poor breeding records, and who want to try vitamin C treatment, the best procedure is to call in a veterinarian. This station has issued directions for vitamin C therapy to veterinarians, and many of them now keep the vitamin on hand.—*Wisc. Agr. Exp. Sta. Bul.* 450.

* * * *

Corn and cob-meal in the proportion of 150 to 250 pounds per ton is a satisfactory preservative for grass silage. It is not quite the equal of molasses or phosphoric acid as a preservative, but is "good enough," according to a report of the Wisconsin experiment station.

Artificial Insemination in Iowa

Dr. W. E. Merritt, Fort Dodge, Ia., sends this picture of the first "test-tube" calf in his territory, born December 22, 1940. The calf, Test Tube Ormsby Sir Bessie, is shown with its dam, Verla Posch Ormsby Ona Inka, No. 1959376. Both are owned by Mr. Ernie Schroeder (left). Mr. Herbert Porter (right) owns the long-range sire, Femco Sir Bessie Cecelia, No. 752588 Doctor Merritt has been doing artificial insemination for over a year, and has succeeded in inducing conception in several cows which had repeatedly failed to conceive after normal breeding. His equipment consists of an artificial vagina, an 18-inch glass speculum, a flash light, a bull syringe connected by a length of rubber tubing to a 24-inch glass tube, and a microscope. He examines the vagina and cervix with the speculum, then passes the glass tube through the speculum directly into the cervix, where the semen is deposited. The semen is examined microscopically before using to be sure of having viable sperms

VETERINARY STUDENTS AT MICHIGAN STATE COLLEGE

Michigan State College has graduated but three women in the Division of Veterinary Science, but there are now eight woman students enrolled in the Division. Left to right: Jean McCallum, '42, Banning, Calif.; Margaret Ascher, '41, New York, N. Y.; Norma Greiner, '41, Grand Rapids, Mich.; Hope Campbell, '42, Madison, Wisc.; Ronny Gillet, '42, Clinton, Mass.; Harriett Harris, '42, Grand Rapids, Mich. In addition there are two second-year students, Betty Wright, Pleasant Ridge, Mich., and Dorothy Shirley, Pontiac, Mich.
Inquiry reveals that a liking for animals dating back to childhood was the chief motive which started these young ladies in quest of a veterinary degree. All plan to have a small animal hospital some day, with the exception of Miss Shirley, whose ambition is to have a general practice of her own

Quarantine History

Quarantine is one of the oldest of the general preventive measures applied for the protection of the public health. Long before man had discovered the causes of communicable disease and the manner of spread, observation and experience had led him to apply the first principle of prevention—isolation of the sick. In the Old Testament there are to be found accounts of crude application of quarantine practice in the isolation of persons afflicted with leprosy for the protection of others from the disease. These early procedures were somewhat harsh, however, as compared with modern methods, for they frequently involved banishment from a city and sometimes death for the afflicted.

In 1485 Venice adopted the rule that all vessels coming from infected ports should be detained for a period of 40 days, during which time they must lie in the harbor without intercourse with land or other vessels. This period of detention explains the association of the word "quarantine" with such sanitary procedure. Some historians suggest that the time limit adopted by Venice was decided upon as a penance in keeping with the ecclesiastical period of Lent. At the time of the establishment of quarantine in Venice in 1485, it is said that it was the Lenten season; and for want of a more scientific reason, for many years "quarantine" meant 40 days' detention.

Quarantine measures have undergone a gradual evolution in the past century, and procedures have become uniform throughout the world. Many changes have been necessary because of the development of knowledge in the sciences of medicine and sanitation, and in the etiology and epidemiology of communicable diseases. International uniformity in procedure has been brought about largely through various international sanitary conferences and the adoption of international sanitary codes by the important maritime nations of the world.

It is only in recent years that the quarantine system of the United States has become completely nationalized. During the greater part of our national history quarantine remained a local function, exercised by state and municipal authorities.

By 1940 the Federal Government, through the United States Public Health Service, was conducting quarantine activities at 52 ports in continental United States, 33 stations in territorial and insular possessions, at 41 airports of entry, in the Panama Canal Zone, and at 17 border stations. In addition, quarantine functions were being performed at other stations and at 41 American consulates in foreign countries in connection with immigration activities.—*U. S. Public Health Reports* 55:28.

Many Factors in Anthelmintic Treatment

A necropsy following the administration of an anthelmintic or other treatment for internal parasites to determine the number of living parasites remaining in the intestinal canal is used by many experimenters as a basis for evaluating a given treatment for parasitism. When this number is compared with the number of parasites eliminated as a result of the medication, the method has the merit of determining with fair accuracy the effectiveness of the agent as a parasiticide under the conditions obtaining when it was used. Others use the eggs-per-gram-of-feces method of determining the anthelmintic efficiency of a given agent; this is likewise a useful laboratory procedure and has the advantage of simplicity and of not requiring the sacrifice of the animal. The information obtained by such methods of course is useful, but there is a tendency in current veterinary literature to give it too much weight in evaluating treatments for parasitized animals. It does not tell the whole story and should not be the sole criterion in judging the comparative value of agents employed in parasite control. The experimenters themselves realize the limitations of the information developed by these means; it is the interpretation placed upon their findings that sometimes leads the clinician astray.

The practitioner is interested primarily, not in killing parasites, but in relieving the host that is suffering from their harmful effects and enabling it to attain a normal production, growth, or gain. This may be accomplished either with or without destroying a portion or all of the parasites, depending upon circumstances. Seldom if ever, perhaps never, is it necessary to kill all the parasites to enable the animal to resume normal existence. Extermination of the parasite is an ideal, like perfect sanitation, the achievement of which is seldom practical for reasons of cost or because of other factors.

The practitioner's direct interest, therefore, in whether a given parasiticide will destroy 75% or 90% or 100% of the parasites present in the intestinal tract is limited to the effect this destruction may have on reinfestation, or the hazard this residual infestation may constitute for other animals, especialy for young animals. This effect is obviously much less direct than is that in the case of surviving external parasites.

Parasitism in animals does not consist simply of a colony of parasites living upon or within a host. If such were the case it might follow that the more numerous the colony the worse for the host, and the more parasites we could kill the more the host would be benefited. The problem is far more complex than that.

It must not be forgotten that the various species of mammals have developed along with their parasites and that perhaps long before man appeared on the earth they had evolved a relationship whe e both parasite and host could lead comparatively normal lives together. If in the course of its development a parasite could not maintain itself in a given host it disappeared; if the host could not survive the depredations of a parasite it succumbed and with it the parasite also. Only the adaptable of both groups have survived to concern us. Treatment of such sub-clinical infestations is justified only by their potential hazard. We cannot be sure that mild infestations doing no clinical damage may not provide an avenue for bacterial invasion or lower the bars to such invasion; or that when the animal is weakened by nutritional inadequacy or exposure to severe climatic influences or abuse in transportation or overwork the balance may not be tipped against the host and in favor of the parasite. Thus treatment requires a careful evaluation of many factors which are not packed in capsules.

The harboring of a "reasonable" number of parasites is to be looked upon as a normal condition for mammals, and such infestation is not measurably harmful. Parasitism refers to a disturbance of the balance whereby the parasite is favored, the host is discriminated against. In the matter of domestic animals, man is the usual disturber, sometimes by confinement causing abnormal exposure to infestation, more frequently by bringing about lessened resist-

ance of the host by reason of inadequate diet, or by hardship, such as overwork, excessive production, inhospitable confinement, etc. In rearing domestic animals and wild animals in captivity, science has demonstrated how to favor the host and discriminate against the parasite, but its teaching is not well heeded.

The treatment of a parasitism is not completed with the administration of a parasiticide, however effective it may be in removing the troublesome parasite. At best that constitutes but a third of the treatment. The condition that brought about the parasitism—the unbalanced relation between parasite and host—must be removed to prevent prompt recurrence of the ailment, and the damage done the host by the parasitism must also receive attention before the job is complete. Since unthriftiness and anemia almost constantly accompany parasitism, providing an improved ration and tonics is as much a part of the treatment of parasite infestation as the administration of the anthelmintic, regardless of the coefficient of effectiveness. A liberal grain ration is more effective in preventing harm from stomach worms in lambs than copper sulphate and nicotine dosing every three weeks. There are some exceptions to this generalization; e.g., bot infestation in horses, in which the animals are benefited by removal of the Gastrophilus larvae, whether or not the ration is improved. Generally, however, the rule applies: More than removal of parasites is essential. Further, removal of all or nearly all of the parasites is unnecessary to the success of the treatment. Of two remedies, one of which is 95% effective and the other 75% effective against a certain parasite, it may very well happen that the latter is the one of choice. Again, removing the parasite is only part of the job. One remedy may make the remainder of the task more difficult than does the other; e.g., carbon tetrachloride treatment may so damage the liver as to make it a liability.

There is undoubtedly a large field for the use of the new anthelmintic, phenothiazine, in the war against parasites. However, its effectiveness against various species, and the acclaim it is receiving, do not lessen the necessity for the other two-thirds of the treatment of animals for parasitic infestation—remedying the conditions that bring about parasitism and treating the damage that has resulted from it.

"Permanent Pastures Perpetuate Parasites"

"Once animals are under fence our parasite cycle begins; increased land values call for more and better stock per acre; more stock per acre means more manure per acre; more manure per acre means more parasite material per acre; more parasite material means greater certainty of infection and greater infection per animal; and greater infection per animal means more worm material for any given amount of manure; and this means more infection per acre, and so on."—*M. C. Hall*, 1928.

The problem of parasites has become more grave since the time more than a dozen years ago when Hall reached the conclusion that, even then, we were losing the war on them. New and better parasiticides have been discovered or developed, but with each discovery of an agent that will remove a higher percentage of parasites from the intestinal tract of an infested animal we make up a few tables of percentages from critical tests of the chemical and think less of the necessity for anything but giving a capsule.

Comes now phenothiazine with its ready adaptability and wide margin of safety, or at least the wide difference between the size of a dose fatal to the parasite and immediately fatal to the host. Then what happens? Farm papers, farm organizations, farm advisers and everyone who farms farmers tell the live stock owner to put it in the feed he gives his live stock.

The problems of animal disease control are complex. Their solution requires the services of experts. Parasitism is not an exception. However, if experts handle these problems inexpertly, they must expect to see their function usurped by others.

Vesicular Exanthema in California

Of outbreaks of vesicular exanthema among swine on 19 ranches in Los Angeles County, California, during 1940, 18 were on garbage feeding ranches. Since there are 43 garbage feeders in the county one can only wonder why there weren't 43 centers of this and all other diseases of swine.

During the past year the outbreaks of vesicular exanthema were of a more severe type than any that have occurred previously. The disease is described in the report of the Los Angeles Live Stock Department for 1939-40, as follows:

This disease is caused by a virus peculiar to hogs. It is characterized by the formation of vesicular eruptions on the mucous membranes and skin of the snout and may extend to the mucosa of the nasal cavity. In some instances severe swellings develop on the snout, which presents a bulbous appearance. The mucosa of the lips, tongue and buccal cavity is frequently involved, showing marked vesicular eruptions. Vesicles may appear on the coronary bands and underneath the pads of the feet. These produce severe lameness which subsides quickly in light hogs after the vesicles break, but in heavy hogs the tissues are sometimes so badly injured that lameness is present for several weeks. Occasionally the inflammation is so severe that they are unable to walk and a few may lose their hoofs. Vesicles are sometimes present on the udders of sows. In acute stages of the disease temperatures of from 105° to 107° F. prevail but after the vesicles rupture the temperature drops to normal quite rapidly. Diarrhea may or may not be present. Death losses directly attributable to this disease are generally confined to suckling pigs. (The aggregate losses of suckling pigs reported by ranchers during the year 1939-40 exceeded 3,000.) These losses are partly due to starvation; the pigs are unable to nurse, as their noses and mouths are sensitive because of the number and character of lesions. In a large percentage of cases where sows are affected lactation is diminished or ceases entirely. It is quite possible that the milk in such cases is toxic from the effect of either the virus or high temperature, or both. Sows which become infected in late periods of gestation frequently abort. A few of them develop metritis, from which some may die and others may become sterile.

The rapidity of spread through a herd varied considerably during this outbreak, depending to some extent upon the size of the ranch and the virulence of the virus. The disease is no respector of age, weight, or color. In some instances heavy hogs showed a larger percentage of visible lesions than light hogs, while in other instances the reverse was true.

Losses other than among suckling pigs were variable and generally low during this outbreak. It is questionable whether the sickness and death of feeder pigs which occurred on some of the ranches could be attributed to vesicular exanthema or to coincidence. Post-mortem examinations conducted upon a considerable number of such cases revealed a very acute gastritis and enteritis with some lymph gland involvement. A few showed pneumonia, metritis, etc. It appeared that the weakened condition of hogs affected with vesicular exanthema made them easy prey for various other diseases. However, the gastroenteritis was very pronounced in some instances, involving the mucous membranes primarily but extending also into the muscular and serous layers of the stomach and duodenum. The discoloration was so "angry" as to suggest caustic poisoning. It is possible that the gastroenteritis and the symptoms which attended these changes may have been due to adaptation of the virus to the epithelium of these structures. Diarrhea in such cases was severe, and bowel evaculations were brown, greenish-brown or slate-colored; only occasionally blood-stained. Many of these hogs died within 12 hours from the time bowel disturbance was first noted; others lived 24 to 72 hours. A few—probably 40% — survived, but it is questionable whether they will make good feeding records. Lesions in those which survived a few days extended into the large intestines. Losses varying from 2% to 10% in certain lots of 50 to 150 pound shotes, resulted from this condition.

When confronted with diseases of this type the establishment of a definite diagnosis is of the greatest importance. Clinical observations cannot be depended upon to differentiate this disease from foot-and-mouth disease. Therefore it is necessary to use test animals on each premise involved to exclude the possibility that foot-and-mouth disease is making its appearance under this guise. In an initial outbreak all the tests available for differential diagnosis are utilized, including inoculation of unexposed pigs, cattle, guinea pigs and horses. Cattle are subject to foot-and-mouth disease but not to vesicular exanthema; therefore, after the diagnosis was determined, calves were used as test animals and placed on all premises upon which infection subsequently appeared. These calves were maintained in the pens with infected hogs. In addition they were directly exposed to the disease by inoculation through abrasions of the muzzle and buccal mucous membranes, using for that purpose the contents of fresh vesicles from infected hogs. The calves were examined daily for a period of thirty days for rise in temperatures and vesicular eruptions. In two calves a papular stomatitis appeared, the lesions of which can be differentiated clinically from those of foot-and-mouth disease.

The measures adopted in the control of this outbreak of vesicular exanthema in this county included the enforcement of rigid quarantine of all affected premises. In this disease, as in others that are highly virulent, early detection is half the battle in preventing the spread of infection to other premises. Quarantine regulations included 24-hour guard service, established immediately upon finding the disease. Our inspectors, the owners, and workers were the only persons allowed entry. The only vehicles allowed to enter the infected premises were the feed trucks, which were cleaned and disinfected upon leaving the ranch. Such rigid quarantine again showed its worth in lowering the percentage of infection of ranches far below that which occurred in areas wherein complete quarantine was not utilized. In this recent outbreak the human factor again proved to be a most likely mode of transmitting disease from ranch to ranch.

An application of fuming nitric acid will often cure umbilical hernia in young pigs. It is ineffective in older animals.

* * * *

Fowler's solution seems to have a beneficial effect in anaplasmosis in swine. It should be administered in the usual way, i.e., in increasing dosage.

* * * *

For posterior paralysis in swine give an injection of calcium gluconate and calcium lactate in the feed. However, examine such cases carefully for broken bones before treating them.

* * * *

Sometimes an owner will complain that his hogs have many abscesses about the throat. Drainage is all the abscesses require but the job is not complete until the cause has been found and eliminated. Sometimes it is splinters on the feed trough or a sliver of iron sticking up on the watering tank or a nail sticking out in some threshhold the animals climb over. Always it is something that injures the region of the throat. Find it.

* * * *

Equal parts of flyspray and neutral oil constitute a good remedy for lice in swine. The preparation should be sprayed over the animals plentifully. They should be crowded together so it will reach only the backs and sides.

* * * *

While suckling her litter the brood sow needs a liberal allowance of concentrates rich in protein and high in minerals, particularly in calcium and phosphorus, important constituents of milk. Dairy by-products therefore are made to order for the sow at this period.

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There is a close relation between the size of pigs at birth and mortality during the suckling period. Pigs that weigh less than 1.5 pounds at birth seldom survive till weaning time. In general, the heavier the pig at birth the better its chance of survival. Except that mature sows produce larger pigs than gilts, the size of pigs at birth is determined largely by the care and feeding of the sow during the gestation period.

The Newspapers Say—

Des Moines, Ia.—Officers of the Iowa Veterinary Medical Association for the coming year are: President, G. G. Baker, Spencer; president-elect, P. V. Neuzil, Blairstown; 1st vice-president, G. A. Hawthorne, Clarinda; 2nd vice-president, M. E. Pomeroy, Stratford; secretary-treasurer, C. C. Franks, Grimes.

Auburn, Ala.—The Alabama Veterinary Medical Association reelected its present officers to serve for the coming year. They are: President, G. D. Ingram, Florence; vice-president, A. L. Halloway, Mobile; secretary-treasurer, I. S. McAdory, Auburn. The next meeting of the association will be held in Mobile in June.

Trenton, N. J.—John T. McGrann, Trenton, is the new president of the Veterinary Medical Association of New Jersey; R. A. Hendershott, Trenton, and J. A. S. Millar, Deal, are vice-presidents; James P. Porteus, Trenton, secretary, and J. B. Engle, Summit, treasurer.

San Angelo, Tex.—Three Dallas veterinarians were elected to office in the State Veterinary Medical Association of Texas when R. L. Dickinson was chosen as president, W. G. Brock as first vice-president, and M. B. Starnes as corresponding secretary for the coming year. C. W. Koberg, San Angelo, is second vice-president, and D. Pierce, Leonard, secretary-treasurer. The 1942 meeting will be held in Fort Worth.

St. Paul, Minn.—At the 44th annual meeting of the Minnesota State Veterinary Medical Society, H. G. McGinn, Brainerd, was elected president for 1941. Fred W. Hansen, Pelican Rapids, is president-elect, and Dale W. Halver, Shakopee, and J. S. Dick, Minneapolis, first and second vice-presidents, respectively. H. C. H. Kernkamp, St. Paul, continues as secretary-treasurer.

Providence, R. I.—Officers of the Rhode Island Veterinary Medical Association for the coming year are: L. F. Maier, Scituate, president; H. F. Ferguson, Newport, president-elect; Harry L. Phillips, East Providence, vice-president; Joseph B. Barber, Pawtucket, secretary-treasurer.

Vicksburg, Miss.—E. H. Durr, Jackson, who has been secretary of the Mississippi State Veterinary Medical Association for the past decade, was elected president of the association for 1941. A. C. Simmons, Jackson, succeeds him as secretary-treasurer, and Bob H. Mayo, Forest, is vice-president. Next year's convention is to be a three-day tri-state gathering of veterinarians from Mississippi, Arkansas, and Tennessee.

Springfield, Ill.—The Illinois State Veterinary Medical Association has elected the following officers for the coming year: President, D. E. Sisk, Mansfield; vice-president, W. C. Glenney, Elgin; secretary-treasurer, C. C. Hastings, Williamsville (reelected).

Phoenix, Ariz.—Officers of the Arizona Veterinary Medical Association for this year are: President, G. G. Crosbie, Tucson; vice-president, D. W. Miller, Phoenix; secretary-treasurer, L. N. Butler, Phoenix.

Sioux Falls, S. Dak.—George E. Melody, Gettysburg, after an eleven-year tenure of the office of secretary-treasurer of the South Dakota Veterinary Medical Association, has been chosen president for the coming year. Serving with him are D. L. Cotton, Beresford, vice-president, and John T. McGilvray, Sioux Falls, the new secretary-treasurer.

Grand Island, Nebr.—The Nebraska Veterinary Medical Association has elected the following officers for 1941: President, G. A. Ackerman, Lincoln; vice-president, R. M. Edwards, Scottsbluff; secretary-treasurer, J. D. Sprague, David City.

Wilmington, Del.—Officers of the Delaware Veterinary Medical Association for the coming year are: President, H. P. Eves, Wilmington; secretary-treasurer, C. C. Palmer, Newark; directors, C. I. Hoch, Wilmington, M. L. Zurkow, Dover, and J. P. West, Milford.

Montpelier, Vt.—At the 33rd annual meeting of the Vermont Veterinary Medical Association the following officers were elected: A. A. Mortimer, Randolph, president; A. D. Spooner, Barre, first vice-president; E. M. Powers, Bradford, second vice-president; G. N. Welch, Northfield, secretary-treasurer.

Madison, Wis.—The 1941 officers of the Wisconsin Veterinary Medical Association are: R. C. Finkle, Seymour, president; J. B. Wilson, St. Croix Falls, vice-president; B. A. Beach, Madison, secretary; W. L. Richards, Morrisonville, treasurer.

Manhattan, Kans.—Election of officers at the 37th annual convention of the Kansas Veterinary Medical Association resulted as follows: President, R. F. Coffey, Topeka; vice-president, H. F. Dotson, Wichita; secretary-treasurer, C. W. Bower, Topeka. S. L. Stewart was elected to the Executive Board.

Augusta, Me.—The Maine Veterinary Medical Association reelected its 1940 officers to serve during 1941. They are: President, S. W. Stiles, Falmouth Foreside; vice-president, A. E. Coombs, Skowhegan; secretary-treasurer, J. F. Witter, Orono.

Columbus, O.—At the 58th annual meeting of the Ohio State Veterinary Medical Association, S. L. Saylor, Canal Winchester, was installed as the new president. The election of officers resulted as follows: President-elect, A. R. Theobald, Cincinnati; treasurer, W. R. Hobbs, Columbus; secretary, R. E. Rebrassier, Columbus (reelected).

Oklahoma City, Okla.—Officers of the Oklahoma Veterinary Medical Association for the coming year are: President, W. F. Irwin, Tulsa; vice-president, J. H. Wirtz, Oklahoma City; secretary-treasurer, F. Y. S. Moore, McAlester (reelected).

Indianapolis, Ind.—At the 57th annual convention of the Indiana Veterinary Medical Association, the following officers were elected to serve for the ensuing year: President, G. E. Botkin, Muncie; vice-president, J. E. Tinder, Brook; secretary-treasurer, C. C. Dobson, New Augusta; directors, Wayne Elder, St. Paul, and T. L. Steenerson, Wilkinson.

Little Rock, Ark.—The Arkansas Veterinary Medical Association elected the following officers for the coming year: President, Fred Thompson, North Little Rock; 1st vice-president, D. F. Eveleth, Fayetteville; 2nd vice-president, F. O. Garrett, Little Rock; secretary-treasurer, W. E. Corry, Little Rock.

Washington, D. C.—Officers of the District of Columbia Veterinary Medical Association for the coming year are: Harry A. Locke, president; A. E. Wight, 1st vice-president; Maj. Charles S. Greer, 2nd vice-president; W. M. Mohler, secretary-treasurer (reelected).

Frankfort, Ky.—Dr. D. E. Westmorland of Owensboro, state veterinarian since 1926, has been removed from office by the State Board of Agriculture and Dr. L. M. Breek of Carrollton appointed to the position. Doctor Breek, age 41, has been deputy state veterinarian since 1929. He was graduated from the Indiana Veterinary College in 1918, and will receive a salary of $2,500 a year. Doctor Westmorland received $3,000 a year, maximum for the position.

Madison, Wis.—Dr. Earl Graves has been appointed Veterinarian in Charge of Research and Extension at the Alaska Experiment Station. Doctor Graves is a graduate of the Kansas State College (D.V.M.) and of the University of Wisconsin (M.S.). His previous experience includes several years as veterinarian for large fur ranches in Alaska, veterinarian at the state game and fur farm, Poynette, Wis., private practice at Plymouth, Wis., and veterinarian for a large fox ranching company in Colorado.

St. Paul, Minn.—Dr. R. L. West, Waseca, has been appointed a Field Veterinarian for the State Live Stock Sanitary Board. Doctor West has practiced in Waseca for the last 22 years. His practice has been taken over by his son, Dr. Ralph L. Jr.

Columbus, O.—Dr. C. W. Fogle of Leipsic has been appointed a member of the State Board of Veterinary Examiners by Governor Bricker for a term ending December 15, 1946. Doctor Fogle is Putnam County chairman of the Republican central and executive committee.

Hernando, Miss.—County agent G. C. Mingee announces that Dr. J. V. Duckworth will spend a week each in DeSoto and Tate counties to treat work stock and do dental work. His schedule will be published. Persons interested in haivng their stock worked on are advised to contact the County Agent.

Blacksburg, Va.—Dr. A. E. Wight, President of the American Veterinary Medical Association, said: "I have no doubt that as a result of the experimental work in progress on equine influenza and periodic ophthalmia being carried on at the Army Veterinary Research Laboratory at Front Royal, we will someday see the end of these two diseases.

"Public health, to a large degree, is dependent upon veterinarians, Doctor Wight claimed. "This is a great responsibility in time of peace, but if war should come the importance of zealous meat inspection would be increased ten-fold. Careful inspection of food for the armed forces is another vitally important function of our profession, performed with great skill by the veterinary corps of the army."

Trembles (Milk Sickness) Produced by Toxic Butter

By JAMES F. COUCH,[1]

Philadelphia, Pennsylvania
Eastern Regional Research Laboratory

EVER since the relationship between milk and the transmission of tremetol poisoning from animal to animal or to man has been recognized, cream and butter have been equally suspected. A number of clinical observations are on record in the literature[2, 3] in which the cause of illness is ascribed to butter made of milk from cows that had fed on white snakeroot (*Eupatorium urticaefolium*). Schmidt[4] relates three outbreaks involving eight patients in which circumstantial evidence pointed to butter as the carrier of the poison. Trembles has been produced experimentally by milk from cows fed on white snakeroot or on rayless goldenrod (*Aplopappus heterophyllus*).[5] No experiments have been reported in which under controlled laboratory conditions, butter has been shown capable of producing the disease. Such an experiment has an additional interest since the discovery of tremetol, the active principle of the plants. It has not been known whether tremetol appears as such in the milk or butter or whether the chemical character of tremetol is changed by the cow's metabolism without its being detoxicated.

In 1934 an opportunity was presented to test these questions. Through the courtesy of E. J. Hubbard, M.D., of Dexter, N. M., there was made available a sample of four pounds of home-made butter suspected of causing four cases of milk sickness in that locality. Rayless goldenrod grows wild in the nearby pastures. The butter was uncolored and unsalted. It contained a few streaks of a greenish, nonpathogenic mold.

Experimental Procedure

A half-pound of the butter was emulsified in water with acacia. Sheep 1676, weighing 33.56kg, in healthy condition, was given by drench ten ounces of the butter-emulsion containing 56.25gm of butter at 9:38 a.m. on July 29, 1935. The animal remained normal and at 3:15 p.m. of the same day the dose was repeated. Two days later, July 31st, the sheep was still normal and showed no symptoms even after exercising. At 10:15 a.m. and 3:20 p.m. the same doses were repeated, making a total of four doses and 225 gm of butter.

On August 2nd the animal was off-feed. Upon exercising, he appeared somewhat unsteady and was quickly exhausted, but showed no definite symptoms of trembles. Later in the day he was weak, was inclined to drag his feet, stumbled several times, was stiff-gaited, and easily exhausted, showing a disinclination to move. He dribbled urine scantily. No actual trembling of the muscles was observed. Nothing new was noted until August 5th, seven days after the first dose of butter. The sheep was exercised for 15 minutes. He was quite disinclined to move, stumbled, was stiff-gaited, and dribbled urine. He became very tired, respired rapidly, and eventually collapsed. He was assisted to his feet but stood unwillingly, attempting to lie down. No odor of acetone appeared on the breath. On further exercising, the animal assumed the typical trembles attitude with legs drawn in and back arched. The haunch muscles began to tremble and then the shoulder muscles, the trembling becoming severe and continuing for several minutes. The sheep finally collapsed and lay on the floor unable to rise.

This was a definite and characteristic case of trembles produced by a sample of suspected butter. The material was then examined for tremetol. The butter (1,288.5gm) was melted by a gentle heat, 58°C., on the water bath and strained through cheesecloth, the water that separated being dis-

[1] Formerly Chemist, Pathological Division, Bureau of Animal Industry.
[2] McCall, A. M., 1823. Observations on milk sickness. *Am. Med. Reporter, 6*, pp. 254-277.
[3] Walker, J. W., 1886. Milk sickness. *Science, 8*, pp. 482-485.
[4] Schmidt, C. H., 1877. Milk sickness. *Cinci. Lancet and Obs., 20*, pp. 411-413.
[5] Marsh, C. D., G. C. Roe., and A. B. Clawson, 1926. Rayless goldenrod *(Aplopappus heterophyllus)* as a poisonous plant. U. S. D. A. Bul. 1931.

carded. The strained butter was dissolved in two liters of alcohol and treated with 320gm of potassium hydroxide in 320gm of water added in portions. The mass was warmed until the whole was dissolved. After two days the alcohol was distilled off and the residue was dissolved in five liters of water. This was shaken out with ether, which removed 2gm of a reddish oil that was negative to the tremetol test.

The soap solution was acidified with dil. sulphuric acid. The fatty acids separated as a liquid layer dissolved in the ether which had saturated the soap solution. This was drawn off and the aqueous solution was thoroughly extracted with ether. On removing the ether by distillation, a total of 1088gm of oily acids with an odor of butyric acid remained. This solidified to a crystalline mass on standing.

The acids were roughly fractionated into a crystalline and a liquid fraction by recrystallization from petroleum ether. There was obtained 342gm of colorless crystalline acids consisting of the higher members of the fatty acid series. The liquid acid fraction contained a small proportion of the crystalline acids.

The various fractions were tested for toxicity to mice. For comparison a portion of the original butter was mixed with nine parts of a basic ration[6] and fed to two mice. Both animals became sick, weak, and showed definite but not violent trembling. Necropsy revealed liver lesions similar to those observed in sheep dead of trembles.

The crystalline acids and the water solution from which the acids were extracted proved to be nontoxic to mice. The liquid acid fraction, however, produced symptoms in mice similar to those produced by the original butter.

An attempt was made to isolate the active substance in this fraction. Two lots of 39gm and 42gm, respectively, of the liquid acids were fractionated in a molecular still, through the kind cooperation of Dr. C. E. Sando of the Bureau of Agricultural Chemistry and Engineering. At a pressure of 0.0008 mm six fractions were obtained from the first lot:

1.	73-110°	0.3gm	mainly butyric acid
2.	120-143°	3.5	caproic, caprylic, and capric acids
3.	143-145°	6.6	stearic, palmitic, and oleic acids
4.	145-146°	13.0	crystallized in part only
5.	146-146.5°	0.5	crystallized
Residue		9.0	a varnish

In liquid air trap less than 1gm.

The second distillation gave similar results. The residue and fraction 4 were tested on mice. The former was nontoxic, but fraction 4 was definitely poisonous. The mice became depressed, and died in five and 14 days, respectively. The necropsy showed enlarged spleens, degenerated livers, and no pneumonia.

These results indicate that the toxic substance secreted in the milk of cows that have fed on rayless goldenrod or on white snakeroot is not tremetol but some derivative of it modified by the animal's metabolism. In converting the oily and neutral tremetol into this acid substance the metabolic processes apparently do not attack the atomic configuration causing trembles.

Summary

A case of trembles or milk sickness has been produced under laboratory conditions in a healthy sheep by feeding butter made from the milk of cows feeding on rayless goldenrod. Chemical examination of the butter revealed the absence of tremetol as such and indicated that this poison had been converted into a toxic substance of acid properties by the cow's metabolism.

[6] The basic ration consisted of equal parts of corn meal, graham flour, and oatmeal with 1% of NaCl and 4% $CaCO_3$.

Recent Materia Medica

X. Posterior and Anterior Pituitary Hormones

Introduction

By PROF. VICTOR LEWITUS
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ALTHOUGH glandular therapy has been employed in one way or another since ancient times, it is only during the present generation that one can rightly state that organotherapy has emerged from the state of empiricism. In fact one might consider that we are still in the transitional phase of the great changes that always follow the isolation and synthesis of certain important substances that make up our medical armamentarium.

The first recorded reference to the medicinal use of animal organs dates back to 500 B.C. when the Egyptians were known to employ testicular substance in the treatment of impotence. The works of Pliny and Galen indicate that they had some vague notion of the existence of glandular secretions which exert a controlling influence on other organs. Even Hippocrates propounded the theory that many diseases were due to certain "humors," and suggested the use of corresponding healthy organs of lower animals to bring about relief. However, with the advent of the anatomists and the discovery of the importance of the central nervous system the old "humoral theory" was soon discarded. But there was bound to be a back-swing of the pendulum, for careful observation disclosed the fact that the physiologic functions of the body are not governed solely by a network of nerves.

Modern scientific endocrinology may be considered as beginning in 1849 with the researches of Berthold, who transplanted testes of cocks to demonstrate that their secretions would still be absorbed to produce male characteristics in the animal. A few years later (1855) Claude Bernard, that brilliant French experimental physiologist who may truly be considered the father of modern endocrinology, substantiated these findings and also hinted that certain glands of the body have both an internal and an external secretion, the former being delivered directly into the bloodstream. However, Brown-Sequard is generally considered to be the founder of the modern science of endocrine therapeutics, for in 1856 he put to test the principle of replacement therapy, employing testicular extracts upon his own person. For a time, the fundamental contributions of these three scientists were vitiated because of the widespread charlatanism of those days and the misapplication of the knowledge thus far attained. However, the work of Bayliss and Starling (1902) in England, and that of Howell (1910) in this country did much to place the subject on a more solid foundation.

Principles of Endocrine Therapy

Hormone products are employed in the treatment of endocrinopathies on the following bases:

1. *Substitution,* in the presence of a condition due to deficiency in secretion, or the absence of a gland (the result of congenital absence, operation, or destruction due to lesions); also to counteract hyperactivity of antagonistic glands. (Replacement of hormonal material does not imply resumption of glandular function in deranged organs or tissues.)

2. *Antagonism,* the administration of one hormone to counteract the effects of another that may be excessive. This principle is being employed quite commonly today, though much more knowledge is necessary regarding certain functions.

3. *Metabolic influence,* since certain hormones, such as those of the thyroid, are intimately connected with regulation of metabolism, it is rational to assume therapeutic response, when properly applied.

4. *Shock therapy,* single large doses of potent hormones have recently been employed with some success in sluggish or otherwise hypoactive functioning of the ductless glands. (Often the endocrine products are used to produce therapeutic shock in ailments other than endocrinologic disturbances.)

5. *Antihormones,* when subthreshold doses of certain hormones are injected, animals may produce their own anti-hormone material to act as antagonists. Passive neutralization

may also be obtained by injection of corresponding hormones into other species. This method is not at present in an acceptable form.

6. *Morphogenetic,* certain hormones, important during the developmental stage of an animal, if continued in action up to or beyond maturity, may cause abnormal or disease conditions.

Present-day application of one or several of these principles combined makes up the rationale for endocrine treatment. There may still be a vestige of empiricism in present-day practice but if so it is gradually being eliminated. It should be pointed out in passing that there is less excuse for the oral utilization of pluriglandular preparations today than at any period since hormone products have been clinically applied.

Posterior Pituitary

The posterior and intermediate portions of the hypophysis or pituitary gland yield substances which upon intramuscular or intravenous injection markedly affect unstriated muscle, particularly that of the uterus and blood vessels. As a result, injections are often followed by increased blood pressure maintained over long periods of time; but at times (especially if too frequent injections are given) the blood pressure may even be definitely lowered. Although the heart is not stimulated, it may be affected because of the change in pressure within the vascular system (e.g. the coronary vessels) and may be depressed because of inanition or vagus influences. Tonicity of the gastrointestinal tract may also be raised by direct effects on the muscular coat. The secretion of urine may be retarded, especially for the first few hours after injections. This antidiuretic action may be due to increased reabsorption of water from the renal tubules into the blood stream; although it is also known that absorption of water from the intestinal tract is delayed and hence reduces the water available for secretion. The tonicity of the urinary bladder is also augmented, especially when it is in an atonic state. Although they may cause temporary acceleration of milk output, the posterior pituitary principles do not actually increase milk formation. An important effect is that upon the uterus. Posterior lobe extracts cause marked contraction of the muscular walls of this organ, especially in pregnant animals, and to a less degree in the nongravid uterus. Because of this property the hormonal preparation is employed in treating uterine atony and various forms of uterine hemorrhage, particularly following delivery. The use of posterior pituitary preparations are contraindicated in humans during the first stage of labor, since when the cervix is not fully dilated, rupture of the uterus due to violent contraction may occur. It is interdicted in the second stage also, since it may be dangerous to both mother and offspring. In animals it is regarded unwise practice to give pituitrin before the cervix is well dilated. Pituitary solutions have been used in the intestinal paresis (paralytic ileus) which often follows abdominal surgery and infectious diseases. Other more powerful parasympathetic stimulants, however, are replacing it for such purposes because of less dangerous by-effects. In diabetes insipidus, the posterior pituitary extracts bring about reduction of the urinary volume.

Recently, the pituitary extract has been fractionated into two components by

It is nearly two hundred years since Borden advanced the theory that certain glands produce an effect through certain substances discharged directly into the blood, but it was a century later before experimental evidence was offered by Berthold to support the concept. Then followed a long period of discussion and conjecture about the "personality glands," the "ductless glands," and the "glands of internal secretion" until one of the most important advances in physiology was made by Starling and Bayliss in the discovery of hormones. The word "hormone" means "chemical messenger," and is most happily chosen for the products it represents.

Kamm, the portion acting on the uterus being called "pitocin" and the other affecting the vascular, intestinal, and urinary bladder musculature, "pitressin."

Summarizing, it may be said that the posterior pituitary gland elaborates chiefly two principles, (1) A *pressor* principle (betahypophamine) which affects blood pressure, urination, and peristalsis; (2) An *oxytocic* principle (alphahypophamine) which markedly influences uterine contractions, especially in the pregnant uterus.

Assay and Standardization

The dried pituitary gland (posterior lobe) and posterior pituitary solution are official in U.S.P.XI. The latter contains the water-soluble principles obtained from domesticated animals and extracted fresh or from the frozen glands. One cc of the solution produces an activity upon the isolated uterus of the virgin guinea-pig, corresponding to not less than 80% nor more than 120% of that produced by 0.005gm of standard powdered posterior pituitary.

Dose and Indications

Posterior pituitary solution may be given to horses and cattle in doses of 3 ii to 3 iiss; to dogs, in doses of ♏viii to ♏xvi. In general, it may be indicated in the prophylaxis of uterine hemorrhage, in dystocia (especially in small animals), in shock, intestinal atony or paresis, and in diabetes insipidus.

Anterior Pituitary

The anterior lobe of the pituitary gland is much more important in endocrine treatment today than was formerly supposed possible. So important are some of the functions which it is thought to control that it is now termed "the master gland." The study of the various factors that make up the pituitary fractions is the subject of much controversy, for it is not known just how many separate elements contribute to its total effect on the animal. At present some seven to nine such fractions are recognized, but their individual functions are not, in all cases, clear.

At present the following factors seem to occur in carefully prepared anterior pituitary extracts: (1) growth factor, (2) follicular maturation factor, (3) luteinizing factor, (4) thyreotropic factor, (5) lactation factor, (6) diabetogenic factor, and (7) ketogenic factor. In addition to these seven important principles, some recent experimental evidence points to the possible existence of two others, stimulant in function, (8) an adrenal-cortex factor (?), and (9) a parathyroid factor (?).

One of the earliest known functions of the anterior pituitary gland was discovered as the result of the early observations of Cushing (1910), who demonstrated that extirpation of the pituitary body brought about atrophy of the sex organs. It was noted that extracts supplied to animals brought about precocious development of the gonads in young animals. Furthermore, the same substance supplied to hypophysectomized animals prevented sexual atrophy. Further study has shown that anterior pituitary extracts are not specific for one sex. In the female, the follicle-stimulating hormone brings about maturation of the ovarian follicles, and the luteinizing hormone hastens lutein-cell formation; whereas in the male, they control the descent of the testes and development of the interstitial cells, as well as the germinal epithelium. Incidentally, it should be noted in passing that there are a number of other hormonal substances which have a gonadotropic influence, such as pregnancy urine, pregnant mare serum, etc.; these will be discussed in a future article of this series.

In 1922, Evans and Long produced giant rats by injecting anterior pituitary suspension, from cattle, intraperitoneally. As a result of their discovery of this effect on growth, it is possible to use mature female virgin rats that have reached the growth plateau in making an assay for this principle. Normal rats remain stationary in growth while animals treated with anterior pituitary principle show gains of 1% daily over a period of at least 10 days.

The lactogenic factor, called "prolactin" by Riddle in 1932, has been shown to affect birds as well as mammals. Six-week-old squabs are used for assay. After four daily

* The term "corticotropic" is being used instead of adrenotropic and adrenal-cortex since the Conference on the Standardization of Hormones uses the term "corticotropin or corticotrophin" for this factor.

injections of the hormone extract, treated pigeons show considerable development of the crop gland, evidenced by increased thickening and rugosity, and about a five-fold gain in weight. The "crop milk" is also secreted in large amounts. In mammals the theory of lactation is as follows: As a result of pregnancy, the mammary glands hypertrophy; the duct and secretory system probably being developed as a result of the influence of estrogens and progestational (luteinizing) hormones. The prolactin probably is the actual milk-secretion stimulant; and during pregnancy this product of the anterior pituitary is inhibited (probably by the estrogenic hormones of the ovary). After delivery, the withdrawal of the inhibitory estrogenic influence results in production of prolactin, which in turn activates the hypertrophied mammary tissue to secrete milk. The fact that hypophysectomy stops milk flow, and that in such animals lactation may be restored by the administration of prolactin, is ample evidence of the necessity of a continuous supply of this hormone for proper functioning of the mammæ.

The thyreotropic factor is necessary for the normal development of the thyroid gland, and if this substance is present in excess it has been demonstrated to cause hyperplasia of the thyroid with subsequent hyperthyroidism in experimental animals.

The diabetogenic principle, associated with the growth hormone, decreases the hypoglycemic response to insulin. Its absence leads to hypoglycemia, preventing to some extent the effects following pancreatectomy in dogs and also certain amphibia.

The ketogenic principle, evidently distinct from the diabetogenic principle, increases the ketone content of the blood of experimental animals.

It was formerly supposed that acromegaly and gigantism were due to overactivity of the anterior pituitary lobe, since pituitary tumors were often found in the study of these conditions. Likewise, under-function of the pituitary was blamed for the syndrome known as dystrophia adiposogenitalis, for experimental extirpation of the gland in dogs was followed by adiposity, dystrophy, and atrophy of the gonads and external genitalia. The newer viewpoint emphasizes the place of the anterior lobe principles in the growth and maturation phenomena already described (including gonadal development); but they are now known to have little or nothing directly to do with conditions such as adiposogenital dystrophy, since in many cases pituitary neoplasm cannot be demonstrated at necropsy. Recent work has shown that hypophysectomy, without affecting the hypothalamus, will not produce adiposogenital dystrophy in adult rats and dogs. In immature animals, ablation of the pituitary is followed by stunted growth and sexual development, a condition which may be corrected experimentally by daily injection of fresh bovine pituitary extract or, in rats, by making anterior lobe transplants.

As to the adrenotropic and parathyreotropic factors and others that are suspected in this complex endocrine gland, it need only be stated that more work needs to be done to establish their presence and functions. Undoubtedly, the anterior lobe of the pituitary gland *is* the master of all glands because of the multiplicity of functions over which it exerts a determining influence. Undoubtedly some interesting revelations are in store for the present generation.

Indications and Dose

Anterior pituitary extracts are indicated to stimulate ovarian and testicular functions (including spermatogenesis) in the absence of, or irregular appearance of, heat periods in females; in faulty conception; and in agalactia of all species. A commercial preparation* (containing 18½ grains fresh anterior pituitary substance per cc) is suggested, to be given as follows:

For large animals: 5 to 10cc
For sheep and swine: 2 to 4cc
For small animals: ½ to 1cc

In human organotherapy, the use of anterior pituitary hormone is at times combined with the use of specific (estrogenic or androgenic) sex hormones when indicated to bring about the expected results. Further, anterior pituitary principles are also often combined with anterior-pituitary-like principles. This will be discussed later.

*Anterior pituitary solution (Fort Dodge).

Occurrence and Cause of an Auricular Sound in the Horse

By ALDO LUISADA, M.D.[1]
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IN TWO recent articles[2, 3] cases of heart block in the horse are reported in which the occurrence of a singular acoustic phenomenon was observed.

As it is known, when a heart block is present, the auricles and the ventricles have a different rhythm, the latter beating with a lower rate. The stimulus arising in the sino-auricular node is able to reach the auricles and to promote their contraction. However, an obstacle blocks its descending march, so that, either periodically or irregularly, some of the auricular contractions are not followed by ventricular contractions. When a permanent and complete interruption occurs, a lower center takes up the function of excitation of the ventricles and their rate, while regular, is much slower than that of the auricles. Therefore, in both the *incomplete block* (with irregularities of the ventricular rhythm) and the *complete block* (with regular and slow ventricular rhythm), there are some auricular contractions that are not immediately followed by ventricular contractions.

It is therefore possible to study, in such cases, certain mechanical and acoustic phenomena in connection with the auricular contraction which are less clear on normal animals.

In the case recently published by Dukes[2] (almost complete heart block), as well as in the first case of Batt[3] (incomplete heart block), an interesting fact was observed; namely the occurrence at times of "a single sound quite similar to the first heart sound. This single sound was not accompanied by any pulsation of the maxillary artery, and occurred when the atria alone contracted."

A similar occurrence has been observed often with heart block in man, but the explanation of it has changed in the last years. At first it was thought that the auricular systole was able to cause an audible sound by the simple fact of its occurrence. Later on, however, and following the observation of negative cases, it was admitted that the sound was chiefly due to the shock of the blood being pushed by the auricles against the ventricular wall. If a sound due to the systole of the auricles is heard, it happens only because the ventricular wall is in an abnormal condition, such as that caused by a process of fibrosis. In other words, the auricular sound heard in heart block has the same meaning as the auricular sound heard in patients without heart block, and having the so-called "gallop rhythm." Gallavardin called the auricular sound of the heart block *le galop du bloc.*

Having recently observed a new case of heart block in a race horse, I have studied by means of a new technique the cause of the additional sound first observed by Dukes.

Technique

The study was accomplished by means of a stetho-cardiette Sanborn. This apparatus allows the simultaneous recording of the electro-cardiogram and of the heart sounds. In our case, the former was recorded by placing under the skin of the shoulders two needles connected with the wires. The heart sounds were recorded by means of a microphone applied to region of the apex.

Records of Normal Horses

A study on normal mammals, using the same technique, has been made recently by the writer and his co-workers.[4] Records of normal horses may be summarized as follows:

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[1] From the Department of Cardiology of the Medical School and the Veterinary School, Middlesex University.

[2] Dukes, H. H., 1940. A case of heart block in a horse. *Cor. Vet.* 30, p. 248.

[3] Batt, H. T., 1941. Three cases of heart disease in horses. *Cor. Vet.* 31, p. 70.

[4] Luisada, A., L. Weisz, and H. W. Hantman. A comparative study of electrocardiogram and heart sounds in normal mammals. *Am. Jnl. Vet. Res.* (in press).

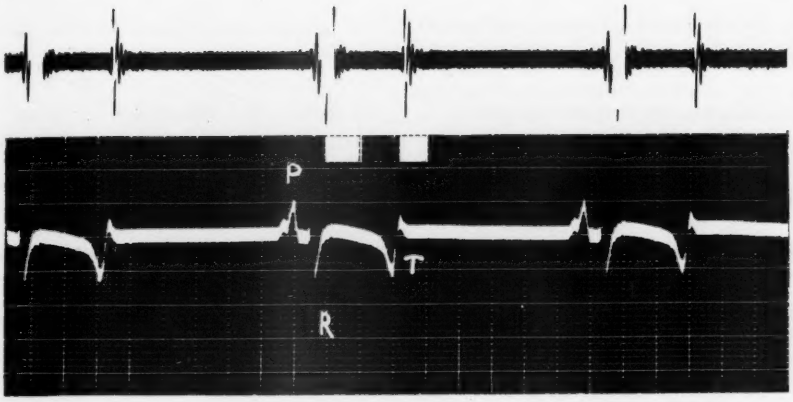


Fig. 1. Electrocardiogram and heart sounds of a normal 27-year-old pony. Short P-R interval (0.20"). Clear sounds. No auricular vibrations. Rate = 35

1. *Electrocardiogram.*—double P wave, long P-R interval (0.25" to 0.42"), sharp and diphasic T wave.

2. *Heart sounds.*—first sound lasting 0.12"-0.24", second sound lasting about 0.08"; usual absence of vibrations due to the systole of the auricles.

Clinical Report

The present case was a four-year-old, thoroughbred gelding, until recently trained for races. The animal was brought to the clinic of the Veterinary School after an accidental tendon injury. However, after repeated questioning, it was ascertained that the animal, during the last weeks, had shown marked and unusual shortness of breath after a gallop.

A routine examination showed a normal heart rate for a race horse (about 27 pulses per minute), and the presence of some irregularities of the heart beat. In some cycles, when the maxillary pulse was absent, a single sound could be heard at the apex.

Cardiographic Findings

1. *Electrocardiogram.*—The rate of the auricular systoles was about 30', the auricular wave (P wave) double, as usual. The P-R interval of the more normal contractions (distance between auricular and ventricular waves) was 0.44", then 0.48", then 0.52". The following systole was typically abnormal, as the auricular systole was not followed by the ventricular (heart block; see Fig. 3).

2. *Heart sounds.*—The second sound was normal. The first sound showed irregular and low vibrations, lasting 0.24". It was constantly preceded by a series of vibrations, evidently due to the auricles, which started 0.36" after the beginning of the first P wave (0.08"-0.16" before the beginning of the first sound), and continued until confused with the first sound.

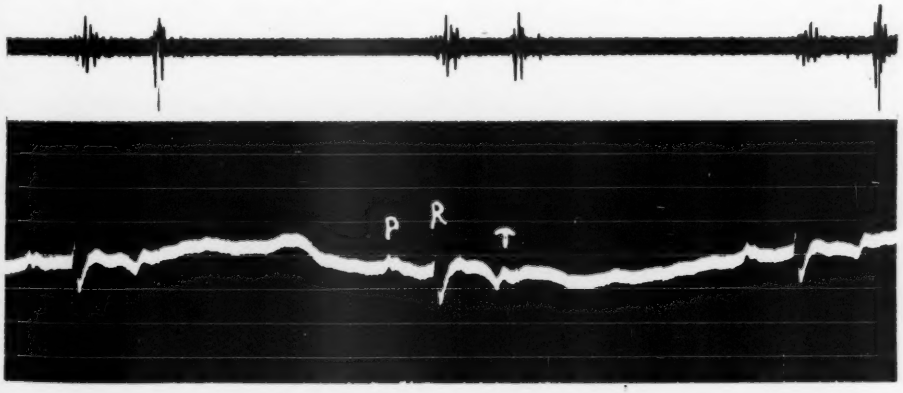


Fig. 2. Electrocardiogram and heart sounds of a normal 10-year-old race horse. Long P-R interval (0.40"). There is a trace of auricular vibrations before the first sound. This is low and short. Rate = 22

When the auricular contraction was not followed by the ventricular, a single heart sound of apparent auricular origin was heard. It started 0.36″ after the beginning of the first P wave and lasted about 0.34″ (see Fig. 3).

Discussion

The clinical symptoms and the electrocardiographic report do not present any difficulties. It is clearly a case of incomplete heart block with periodic lengthening of the P-R interval until a single auricular contraction is not followed by the ventricular; the stimulus finds more and more difficulty in passing, until it is blocked.

The record of the heart sounds, on the other hand, shows some unusual features. First is the low and prolonged series of vibrations which constituted the first sound—evidently an expression of some lesion of the ventricular myocardium. Second is the presence of a sound due to the contraction of the auricles. It was possible to study this sound well during the block. The most notable features were its long duration (0.34″, more than 1/3 of a second) and its delayed occurrence (0.36″ after the beginning of the auricular waves). In man the auricular sound starts 0.018″ to 0.074″ after the summit of the P wave, with an average of 0.043[5]; as the duration of the P wave in man is about 0.10″, the time relation of the beginning of the auricular sound to the beginning of the P wave is about 0.10″ (1/10 of a second). Therefore, in this horse the auricular sound occurred after a delay three times as long as that of man.

A possible explanation of this phenomenon is as follows: Some authors[6, 7, 8] believe that the first of the two P waves of the horse is the expression of the excitation starting from the sino-auricular node. If this should be true then only the second P wave should be due to the excitation of the auricles and the time-interval between the latter and the sounds would be reduced to 0.24″. As I have already pointed out,[4] however, this hypothesis is hardly supported by facts.

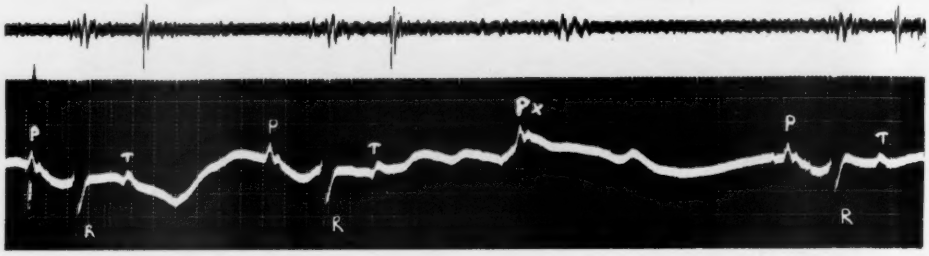


Fig. 3. Electrocardiogram (lower record) and heart sounds (upper record) of a 4-year-old race horse with incomplete heart block. P-R interval growing from 0.44″ to 0.52″. The third systole is blocked (Px). First sound low and irregular. Auricular sound always present (a) but clearly evident when the auricular systole is not followed by a ventricular contraction

In man and in the dog many different causes are assigned to the normal auricular sound[9]: (1) the muscular contraction itself; (2) the tension of the auricular walls; (3) the passage of blood through the valvular orifices; (4) the distention of the ventricular walls by the onrush of blood from the auricles, and (5) the friction of the auricles against neighboring structures.

When the auricular sound becomes audible usually a longer time interval exists between auricular and ventricular systole (longer P-R interval due either to myocardial disturbance, or to myocardial fibrosis), and a fibrosis of the ventricular walls gives more evidence to the fourth factor.

In the case reported a myocardial lesion, probably due to a myocarditis, increased

[5] Caeiro, A. and O. Orias, 1937. El fonocardiograma registrado en los distintos focos de auscultación. *Rev. Arg. de Cardiol.* 4, p. 71.

[6] Einthoven, W., 1908. Weiters über das Ekg. *Pflügers Arch.*, 122, p. 517.

[7] Kahn, R. H., 1913. Das Pferde—Ekg.—*Pflügers Arch.*, 154, p. 1.

[8] Nörr, J., 1913. Das Ekg des Pferdes. *Zeit. f. Biol.* 61, p. 197.

[9] Orias, O. and E. Braun-Menendez, 1939. *The Heart-sounds in Normal and Pathological Conditions.* (Oxford Univ. Press.)

the possibility of hearing the auricular sound. The exceptional length of this sound may be explained by observing the length of the auricular waves of the horse (the electric waves due to auricular action may be called the "auricular complex"; the duration of this is usually about 0.20″).

A very interesting fact is the tremendous delay between electric waves due to the auricular systole and auricular sound. The explanation of this is still lacking. However, some interesting facts may be deduced: (1) the blocked auricular systole shows clearly the auricular sound; (2) the preceding systole, which has a prolonged P-R interval, shows about one-half of the auricular sound; (3) the usual systoles of this case show only 1/3 of the sound.

As even these have a longer P-R interval, it is possible that normal horses have auricular vibrations mixed with the ventricular vibrations of the first sound. It should be impossible, therefore, to distinguish the auricular from the ventricular component of the first sound. This would be possible only if the normal horses should have a delay between auricular and ventricular contraction (long P-R interval) as in the the case described.

However, a normal myocardium does not cause as loud vibrations as does the myocardium of sick animals, hence the eventual auricular component is certainly much less important in physiological than in pathological conditions.

Summary

1. A clinical case is reported in which heart block occurred in a race horse, the blocked auricular contractions being accompanied by a single heart sound.

2. A graphic study was made on the animal by the simultaneous registration of the electrocardiogram (ecg) and of the heart sounds (phonocg).

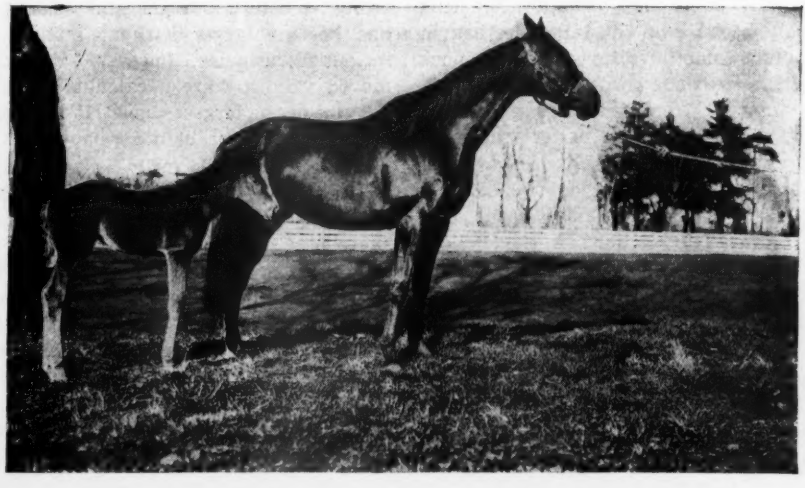
3. The ecg reveals an incomplete heart block with periodic lengthening of the interval between auricular and ventricular waves, until an auricular contraction is not followed by the ventricular.

4. The phonocg. reveals that the single heart sound during the block is an auricular sound.

5. A study on the causes of this is presented.

6. Contractions previous to the one with the block show in a more or less clear way the presence of the auricular sound, a fact which is abnormal in horses.

7. Because of the marked delay between auricular P waves and auricular sound, it is assumed that in normal horses the auricular sound may occur simultaneously with the first sound. A normal myocardium, however, does not cause as loud vibrations, as did that of the animal studied.



The Removal of Cystic Calculi

By T. A. SIGLER, Greencastle, Indiana

CYSTIC calculi occur more commonly in our domestic animals than is generally believed by most veterinarians. Textbooks tell us that urinary calculi are not common in the horse, being much more frequent in dogs and cattle. My experience has not supported this view as to their rarity in the horse. I think they are frequently not diagnosed, attracting attention only when they accidentally flow into the urethra and obstruct the passage of urine from the bladder.

In the ox and dog the rule is for calculi to be small and numerous. Large stones, too large to enter the urethra, are the exception. In the dog they usually lodge just behind the os penis, and in the ox at the first part of the sigmoid curve. They are easily removed from either location. Many times, however, especially in the steer and bull, the bladder may be ruptured before a veterinarian is called. This is followed by ascites and often large edematous swellings. Diagnosis is fairly easy in cattle, especially in the male, there being more or less elevation of the tail and a pulsation of the rectum.

In horses, however, urinary calculi are apt to attract no attention until they have grown large enough to obstruct the flow of urine from the bladder. Small ones may escape with the urine without attracting attention, because of the large urethra in this animal. Sometimes, however, they block the urethra near the border of the ischium. Last summer I treated such a case in a gelding, which had been under treatment for colic the day before. I chanced to be in the community, operating on a case on a nearby farm in consultation with the local veterinarian. The owner of the colicky horse came over to tell him that the animal was no better. He stated that there was a lump under the anus. We removed a very large stone.

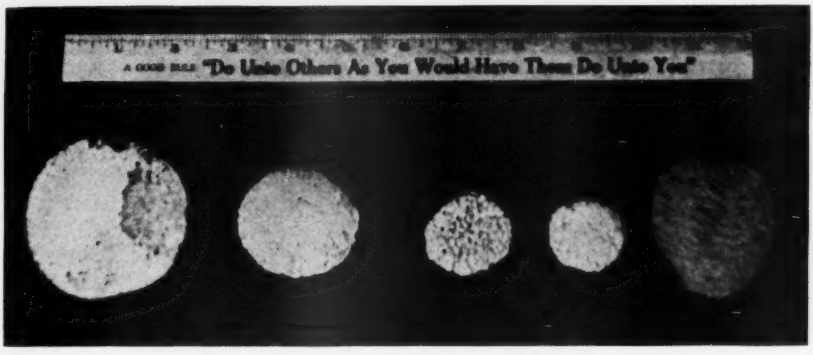
Generally the practitioner declines to interfere when urinary calculi are discovered, so long as they do not obstruct the flow of urine. The fact is, however, this I believe to be a mistake since the longer they stay in the bladder, even though they do not obstruct the urethra, the more cystitis and thickening of the bladder they cause. It is frequently a good plan to make a rectal examination to ascertain if calculi are present in the bladder in animals that are showing colicky symptoms. Large stones in the bladder, in both stallion and mare, even though they have not yet obstructed the flow of urine, many times cause uneasiness, and where there is a good deal of cystitis and irritation around the neck of the bladder, will cause the affected animal to stand in the attitude of micturition for some time after voiding. If the animal is used for road work, especially the light horse, both male and female will pass blood following urination, if there is only one stone and it is a rough one. (Most of these calculi in the horse are rough.)

When a calculus has obstructed the urethra and stopped the passage of urine, the animal breaks out in a sweat, rocks from one hind foot to the other, and attempts to urinate. Having operated upon a great many such cases, I have quite a collection of fine specimens. Those shown in the illustration indicate the range in size. Calculi smaller than those shown are generally voided unnoticed and seldom does one become larger without setting up a serious disturbance. However, I recently removed from a mare a calculus fully twice the size of the largest shown. It was crushed into many pieces before removal.

Cystic calculus is farily easy to diagnose in the horse. In most cases even though there be no obstruction of the urethra, there is a thickening of the bladder walls, and blood is passed with the urine at times. If the calculus is lodged in the urethra, obstructing it, the diagnosis is all the easier, because the animal exhibits all the well-known symptoms of frequent straining as if to urinate, with passage of but small quantities of urine, or perhaps only a few drops mixed with blood.

Urethrotomy

In large animals the operation for the removal of a calculus lodged in the urethra should be performed, if possible, when the bladder is fully distended and with the animal in the standing position, controlling the pain by local anesthesia. The standing position is convenient for the operator, there is less displacement of structures, and less danger of rupture of the bladder which might occur from casting the animal. However, if the animal is cast, sufficient chloral hydrate should be used to put it down without a struggle.



Some of the calculi removed from horses by the author

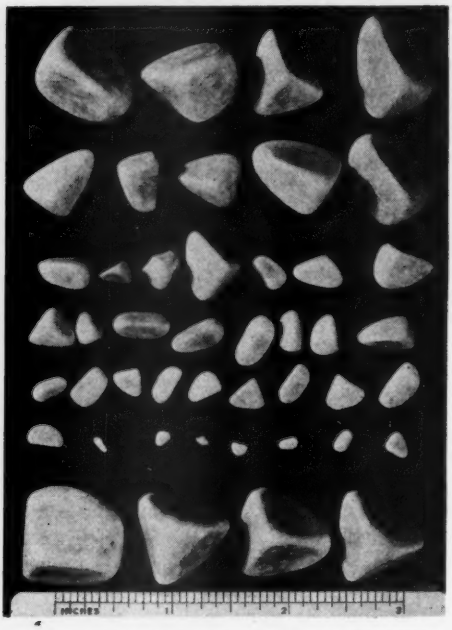
In the stallion and gelding, the operation is usually performed at the ischial arch. The calculus is usually lodged anterior to that point or is still in the bladder. The structures which overlie the urethra in the perineal region are: skin, perineal fascia, the retractor penis muscle, and the bulbocavernosus muscle. Beneath this latter lies the urethra itself; the artery of the bulb, one of the terminal branches of the internal pubic artery, enters the base of the penis on either side of the median line. It must be avoided in operating.

With a very sharp knife, make an incision on the median line, perpendicular to the surface, beginning at the level of the ischium and continuing downward a distance of three to four inches. The incision in the skin should be the longest and the incision in each succeeding structure from without to within should be a little shorter at the lower commissure, so that the escape of urine and wound discharge will be outside and with little tendency to migration beneath the skin. Retract the wound edges and control the hemorrhage, recognize each structure as it is exposed, keep the incision exactly on the median line, so that it will pass between the two retractor muscles and thus avoid injury to the artery and its accompanying vein. There should be almost no hemorrhage until the corpus cavernosum is incised if the incision is properly made. When the corpus cavernosum is incised there is quite a little hemorrhage, which will help to identify the structure. When this has been divided, the mucous membrane of the urethra appears as a reddish membrane, or the urine begins to flow unless the bladder is ruptured. If a catheter has been passed and left *in situ* during the operation, cutting down upon it will identify the urethra.

Grasp the cut edges of the urethral mucosa with forceps as soon as it is incised, so they can be identified later without searching. Passing the forceps into the urethra, the instrument is guided by one hand inserted in the rectum and placed upon the stone. After the calculus has been grasped, the forceps should be rotated, moved backward and forward to raise the stone out of its imbedded position and make certain that no fold of mucous membrane is included with the stone in the grasp of the forceps. If the stone is too large to be extracted, it may be reduced in size by crushing or chiseling away, but the struc-

tures are capable of considerable distention under patient traction.

The operation for the removal of calculi is similer in all species of animals. In cattle intended for butcher purposes, it



Calculi removed from a dog.—*Photo by R. S. Todd*

may be used temporarily to drain the bladder until the animals can be marketed. In cases where the urethra is filled with many small stones throughout its length, it is sometimes cut off and dissected back and a false opening made for the passage of urine.

I have used the method described by Wegner in operating upon bulls, using a flexible fuse wire that has been smoothed at the end. The penis is withdrawn to obliterate the sigmoid curve, after which the sound passes through it quite easily. The penis cannot be withdrawn, however, unless the animal is cast and a general anesthetic administered or extradural anesthesia induced.

The ox is usually affected with small and numerous calculi lodged at the height of the *s*-curve of the penis, and extending back over a great length of the urethral canal. It is practically impossible to remove them all. In such cases, an operation performed at the height of the ischial arch to provide exit for the urine, will allow the animal to be marketed. Sometimes, even in the ox, there is just one well-formed stone at the first curvature of the sigmoid which can be removed readily and the urethra sutured, the animal making a good recovery.

In the mare, the removal of the calculi is much simpler. The operation may be performed with the patient in the standing position by using breeding hopples, but the recumbent position under general anesthesia is preferable and helps to relax the structures and make extraction easier.

The lithotomy forceps is introduced into the bladder through the urethra and with the aid of the hand in the vagina the stone is grasped. In most cases, by careful rotation and traction, using lots of patience, the urethra can be dilated sufficiently to make possible the withdrawal of the calculus. Or a probe-pointed bistoury may be introduced into the urethra and it may be slit forward as the stone is drawn backward. No aftercare is required. The wound usually heals rapidly. In most cases it is unnecessary to slit the urethra. I have removed some very large stones from mares by rotating and patiently dilating the neck of the bladder and urethra. In some cases, I have been able to break up the stones. This makes it necessary to wash out the bladder.

Cystic calculi are quite common in dogs. I have operated upon a number through the prepubic or median line incision. The bladder is drawn forward, and the incision through the walls of the bladder is made at the highest possible point. The bleeding which is always more or less abundant from the inflamed and thickened bladder wall should be arrested. The incision is closed with fine catgut. The abdominal incision is closed in the usual manner. I have never tried the technique of White, of fixing the bladder to an adjacent wall to protect it from contracting and so preventing healing. A few years ago, the late Doctor Quitman recommended for the aftertreatment of such cases a compound of sabol, zea maize, and saw palmetto; I use such a preparation.

Hemorrhagic Septicemia?

A telephone call was received from a client 20 miles away, who stated that he had two choked mules. As chokes in pairs are somewhat unusual I speculated as to the trouble.

Upon arrival at the farm two mules were found, both of which exhibited some indications of thoracic choke. One was down and unable to rise and had a temperature of 102.5°F. The other was able to walk, unsteadily, and had a temperature of 102°F. Both were drooling stringy saliva and made movements of the throat which seemed to be efforts at deglutition. Both had accelerated respiratory movements, somewhat shallow in character. The nasal mucosae and conjunctivae were swollen and petechiate. Neither mule would eat even when food was placed in their mouths. The pulse of both was accelerated.

At the insistence of the owner the stomach tube was passed without encountering obstruction in either animal and a couple of gallons of water was pumped into the stomach in each case. Apparently this neither relieved nor aggravated the symptoms.

The only history available was that the mules had failed to consume their usual rations of grain and hay the previous evening. Further questioning concerning the possibility of some kind of poisoning elicited the information that a dead hen had been found in the watering tank two days previously. The hen was removed but the tank had not been cleaned.

Treatment for inflamed mucous membranes was administered as well as general stimulants. Prognosis was guarded and the owner was asked to call me should either mule die. The downer mule was found dead next morning and I was notified at once.

Autopsy findings were: pharyngeal, laryngeal, tracheal and esophageal mucosae badly swollen and covered with petechiae. Surrounding the trachea and esophagus just within the thorax was a large mass of gelatinous exudate. Petechiae were plentiful on the visceral and parietal pleurae. Epicardium and pericardium were petechiate and the pericardial sac contained about 50cc of fluid exudate. The myocardium contained several blood extravasations and a few similar extravasations were found in the lung substance. The gastric mucosa was intensely inflamed and hemmorhagic, as was also the duodenal mucous membrane. Many petechial hemorrhages were found throughout the peritoneum of the small intestines. The visceral and omental lymph glands were enlarged and infiltrated with fluid. The stomach and intestines were almost empty, showing that little food had been taken for several days. The kidneys also were petechiate, the blood tarry. A "chicken fat" embolus was found in the right auricle.

The second mule was now in lateral recumbency, and died during the following night.

No history nor evidence of any poisonings, either vegetable or mineral, could be found after search of the premises, including a pasture of several acres. This, and the evidences of infection, the history of the hen carcass having been found in the water tank from which the mules obtained their only water supply, and there being no other sick animals in the vicinity exhibiting similar symptoms led to a diagnosis of hemorrhagic septicemia, probably derived from fowl cholera infection in the dead hen.

The farmer was instructed concerning the thorough cleaning and disinfection of the premises and told to be on the lookout for the appearance of cholera among his fowls.

W. M. BURSON.

Athens, Ga.

FATAL COLIC IN A MULE

The nostrils are widely distended, the breathing deep and labored.—*Photo by E. T. Baker*

Complications Following Nail Prick

October 23, 1940, an aged black gelding was presented at the veterinary clinic of Kansas State College for treatment of a nail prick at the point of the frog of the right front foot. The animal was noticeably lame, but its temperature, pulse, and respiration were found to be normal.

After a thorough examination of the injured foot, a 1-1000 mercuric chloride pack was applied and a prophylactic dose of 1,500 units of tetanus antitoxin was administered subcutaneously. Two days later, the lameness had subsided and the animal was released from the hospital.

October 29th the animal showed severe disturbance of the central nervous system—motor irritation, ataxia, and total blindness—accompanied by paralysis of the pharynx, hyperidrosis, and radial paresis of the right front foot. Trauma was evident about the face and breast. The temperature was 99.6°F. and pulse and respiration were normal; but a blood examination revealed a total R.B.C. count of 7,150,000 and a W.B.C. count of 18,000 (!) with a very high percentage of immature leucocytes. A fecal examination was positive for strongyles. Diagnosis was withheld; prognosis was rather unfavorable.

The original wound was suspected as being responsible for the condition, but careful examination of the foot revealed no symptoms of infection; rather, it seemed cooler than the other foot on palpation. However, symptoms may have been obscured by radial paresis and deranged consciousness.

Treatment consisted of 600gr of sulfanilamide per os on each of three consecutive days, along with the daily administration of one liter of normal saline solution and one pint of 25% dextrose solution, intravenously, to combat dehydration. Nourishment was given via stomach tube because of pharyngeal paralysis. Mild laxatives of magnesium sulphate and mineral oil were administered. The animal continued to show disturbances of the central nervous system—radial paresis and total blindness, with incoordinated movements—and euthanasia was carried out November 13th.

Necropsy Findings.—A thick, viscid exudate was found on the floor of the cranial cavity. The optic nerves were noticeably enlarged, and retinitis was present. A pale thrombus was found in the median artery in the right front foot at about the level of the knee. The brachial artery and its branches were filled with propagating red thrombi. Pale streaks were visible throughout the muscles of the arm. The parietal peritoneum was red and somewhat roughened, with many small tags of fibrin. No evidence of inflammation was found in the region of the frog.

It appeared that the original infection had metastasized via the blood stream from the region of the foot to cause the arterial thrombosis, retinitis, peritonitis, and encephalitis, with resulting radial paresis, blindness, colic, and motor irritation.

BERNARD BUSBY, K.S.C. '41.

Manhattan, Kans.

* * * *

A CASE OF KELOIDS

Minor injuries can have annoying and even serious consequences if they are not treated correctly and promptly. This sample of exuberant granulation followed a minor wire cut, after the owner had applied powdered alum, slaked lime, blue vitriol, white arsenic, zinc chloride, several cancer pastes and tried to burn it off. Other than this, nothing had been done when the writer was called. A surgical operation was performed.—E. T. B.

Libido in a Castrate Dog

The patient, a Mexican hairless, gentle in disposition, when first presented on September 4, 1940, was a chronic masturbater at the age of two years, with no external signs of hypergonadism. The client complained that the dog's indiscriminate practice was most embarrassing.

Castration was recommended and a routine midline operation was performed, the incision being made in the skin of the prepuce about one inch anterior to the scrotum. The testicles were then displaced forward, pulled through the incision, the cords and blood vessels ligated and severed with a small écraseur.

Following the operation masturbation ceased and, apparently, the sex life of the dog had terminated. Imagine the client's and our amazement, then, when on November 8th, two months and four days following the castration, the patient mounted and tied with a Boston Terrier bitch in heat. The Boston was an aged virgin, a pampered pet belonging to the client's mother, and they were both very much perturbed by the incident.

At our suggestion the Mexican hairless was returned to the hospital where ejaculation was induced and the secretion collected. A drop was placed on a slide, mixed with a drop of methylene blue, a cover slip added, and the semen examined microscopically. The examination revealed a profusion of prostatic epithelial cells, but no spermatozoa.

This, of course, did not prove that there were no viable spermatozoa in the semen at the time of copulation (which was the first ejaculation following castration), and we could not at first be sure that we would not be presented shortly with a unique litter of Hairless Bostons. However, 63 days having come and gone, it is with a sigh of relief that we report the final score as: no runs, no hits, one error.

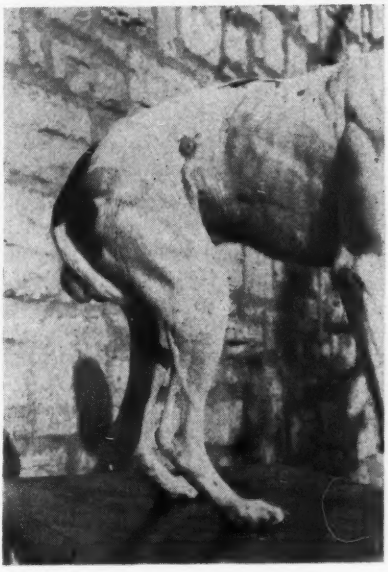
This experience has demonstrated dramatically that the regression of sex life following castration is not always as rapid as we had heretofore believed.

J. George Feinberg,
R. M. Codd.

Norfolk, Virginia.

Fibro-Adenoma with Cellular Infiltration in a Dog

A three-year-old, male pointer in unthrifty condition was presented at the veterinary clinic of Kansas State College No-



Fibro-adenoma in a dog

vember 11, 1940. Several moderately soft, somewhat pendulous growths were observed on the hind quarters and tail of the dog. The owner informed the clinician that these tumor-like growths had gradually appeared one by one over a period of two years. Other than these tumors and the dog's unthrifty condition, no pathological symptoms were present.

It was decided to remove five of these growths, ranging in size from one to four centimeters in diameter. There were a few growths apparently in process of formation, but it seemed inadvisable to remove them.

The areas were shaved and a skin antiseptic applied. Local anesthesia was obtained by injecting 1% procaine into the areas. Elliptical incisions were made around the tumors and they were carefully dissected from the underlying connective tissue. The skin incisions were closed with braided silk sutures, using mattress and interrupted sutures as indicated.

Although examination of the feces by the flotation method did not reveal the presence of parasites, the dog's unthrifty condition was a strong indication of infestation, and gastrointestinal lavage with 1% hydrogen peroxide was employed. Numerous tapeworms and a few roundworms were expelled.

The dog was sent home and the owner was advised to provide him with warm, sanitary quarters and to feed him with large quantities of meat to condition him for the approaching hunting season.

On sectioning and microscopic examination the tumors were found to be fibroadenomas with a cellular infiltration of polymorphs and plasma cells. No explanation was found for the cellular infiltration; there was no evidence of the pus or infection which usually accompany such infiltrations.

VIRGIL R. KELLEY, K. S. C. '41
Manhattan, Kans.

* * * *

Feline Gastric Ulcers

June 23, 1940, a three-year-old yellow Persian cat was presented for treatment at the Charlotte Veterinary Hospital of Charlotte, N. C. The cat was vomiting everything she ate and was becoming emaciated rapidly. She was quite listless. Her temperature was 100.4°F. The skin showed evidence of dehydration. Her diet for some time had consisted of canned dog food.

Tentatively diagnosing the condition as a temporary digestive upset, Dr. R. H. Parker administered an enema and gave symptomatic treatment, including 2cc of neoprontosil subcutaneously three times a day; 25cc of 10% dextrose and isotonic saline solution, to keep the water balance and furnish energy; and nausea tablets, composed of bismuth subnitrate, 2gr, cerium oxalate, 2gr, and procaine, ¼gr, to combat the emesis. After four days of this treatment, much improvement was noted, and the cat was sent home.

July 9th the cat was returned to the hospital, again vomiting everything she ate. She was given 25cc of 10% dextrose in isotonic saline solution subcutaneously for two days, but no improvement was apparent. An enema was given to unload the colon and rectum and to stimulate peristalsis.

July 12th, the diagnosis still being uncertain, a gastrocopic examination was made. Five grains of nembutal intravenously accomplished complete relaxation. A Cameron gastroscope (a small tube long enough to reach the stomach, with a light on the end and a telescopic lens) was lubricated with vaseline to overcome esophageal friction and inserted into the stomach. By swabbing the tube with cotton to remove the gastric fluids, regulating the swabbing with the respiratory movements, it was possible to visualize the gastric mucosa. In the pyloric region of the stomach were seen red ulcers about the size of a dime.

A provisional diagnosis of gastric ulcers resulting from vitamin C deficiency was made on the basis of the history of prolonged feeding on canned foods and the general resemblance of the cat's condition to that of scurvy in man. It appeared highly improbable that the ulcers had been caused by the ingestion of any chemical or poison, since the cat lived in an apartment and was carefully watched over, and since she had the dainty feeding habits of most Persians.

Subcutaneous injections of 25cc of 10% dextrose in physiological saline solution were given daily, and in addition the animal was given one vitamin C tablet (500 I.U.) twice a day and one ounce of orange juice every two hours. Recovery was slow, but in a few weeks the cat was able to eat without becoming nauseated.

The diet recommended when the cat was returned to its home included: sweet milk, some fish, liver, vetgables, meat (raw lean beef), and plenty of fruits and green foods, such as raw cabbage, lemons, oranges, grapefruit, tangerines, and tomato juice.

Obviously, improvement in the animal's condition on the regimen mentioned does not constitute a substantiation of the diagnosis, but the case is reported as suggesting an interesting possibility in the etiology of such cases.

GEORGE R. ARMSTRONG, K.S.C. '41.
Charlotte, N. C.

Trichomoniasis in a Puppy

January 14, 1941 a female collie puppy, seven weeks of age, was presented to the veterinary clinic of Kansas State College for treatment. The history was as follows:

The patient had been in good health and condition until one week previous to hospitalization, when she showed signs of anorexia and began to lose weight. A diarrhea then developed, becoming progressively more severe.

The temperature of the puppy when examined was 101°F. A fecal examination revealed the presence of a great many motile spherical bodies equipped with flagella and an undulating membrane. These bodies were identified as a species of Trichomonas. Anemia and dehydration were pronounced. Ten cc of canine anti-distemper serum (homologous) was given subcutaneously, and seven grains of sulfanilamide in divided doses was given per os. The patient was then returned home.

January 17th, no improvement having been noticed, the puppy was returned to the hospital. The watery diarrhea was still persistent. The temperature was 104°F.

A fecal examination was still positive for trichomonads. The puppy was given five grains of sulfanilamide.

January 18th, 15 grains of sulfanilamide was given in three 5-grain doses. The temperature had fallen to 98°F. Fecal examination showed a decrease in the number of parasites. The feces had also become more firm in consistency.

A blood count showed the following picture:

Total red cells..... 3,025,000
Total white cells..... 6,800
Hemoglobin..... 10 mg per 100cc

The differential count showed 23% stabs—a distinct shift to the left.

On the morning of January 19th, the puppy was found in a comatose condition. The corneal reflex was gone and the respirations were very slow and weak. She died about noon.

A post-mortem examination revealed:

1. The thorax was normal.
2. There was a mild, diffuse congestion of the gastric and intestinal mucosa with slight hemorrhage, shown by clots of blood.
3. The cecum was tense and tightly coiled. The serous wall showed numerous small round lesions (pinhead size) that appeared to contain clear, watery fluid.
4. The liver and spleen showed no gross changes.
5. The kidney was firm in consistency, the capsule quite adherent. On section the cortex was a dark mahogany color.
6. The small intestine showed an intussusception in the middle of the lower third, which had occurred near or following death.
7. A stained smear of the bladder mucosa was positive for distemper inclusion bodies.

The presence of the trichomonads may have lowered the resistance of the puppy, permitting the distemper virus to establish itself in a highly virulent form, thus causing the death in spite of the treatment.

As far as the author is aware, this is the first time this protozoon has been reported as a possible pathogen in dogs. Apparently harmless species of Trichomonas inhabit the intestines of practically all mammals. *T. hominis* has been accused of causing diarrhea in man when present in large numbers.

K. L. Bruce, K.S.C. '41.
Orchard, Nebraska

Vitamin B Therapy in Leucoma

Leucoma (cloudiness of the cornea) is a common affection of animals, and is sometimes quite difficult to treat. It is often complicated with keratohelcosis (ulceration of the cornea).

A wirehaired fox terrier bitch with a marked leucoma and keratohelcosis of left eye was presented to a small animal hospital in Cheyenne, Wyoming, for treatment. Considerable pain was evidenced by lacrymation and constant rubbing of the affected eye by her paws. Infection had been thus introduced, and panophthalmia had developed. Less radical therapy having failed, enucleation of the eyeball was carried out. A satisfactory recovery from the operation followed.

Four months later the bitch was again presented for treatment. Some pain and loss of vision in the remaining eye were evident. It was found that a leucoma had developed,

Loss of vision was evident, and it was found that a leucoma had developed

and by means of an ophthalmoscope several small ulcers were detected on the inner surface of the cornea. A glaucoma was suspected from the cloudy sea-green appearance of the eye, but because of the opacity of the cornea, a deep examination for damage to the optic nerve papilla was impossible.

Dogs maintained as house pets do not always receive a proper diet; thus, a chronic vitamin deficiency could easily be a factor in eye pathology. With this thought in mind 30mg of thiamin chloride was given intravenously once daily, accompanied by oral administration of vitamin B-complex capsules twice daily. The thiamin chloride therapy was continued for two days and the vitamin B-complex therapy for several days longer. Noticeable improvement of the corneal condition was apparent 12 hours after the first administration of the vitamins, and complete recovery from this condition occurred in four days. Failure of the pupil to contract following treatment indicated a nerve involvement, with possible atrophy of the optic nerve. After the cornea had cleared, examination with the ophthalmoscope revealed no glaucoma; this may have been, however, a primary factor in the condition. Failure of the pupil to function properly resulted in hyperopia, vision being impaired below a distance of five or six feet.

Vitamin treatment would obviously be of no value in repairing injured nerve tissue, but remarkable results were apparently attained in this case in curing the leucoma and keratohelcosis, and these results justify further trial of the administration of thiamin chloride and the vitamin B-complex in such eye conditions.

RODNEY I. PORT, K.S.C. '41.

Cheyenne, Wyoming.

* * * *

A Holiday Episode

The day before Christmas, about nine in the morning, one of my clients called up about his dog, who was acting queer, he said, and he was afraid the animal was poisoned.

Now, there is a little history connected with this pooch, for about eight years ago, when a small puppy, he was brought in to be immunized against distemper. Later on he was severely injured by a mowing machine. Then again, Bowser was the constant friend and playmate of our client's only child, a little girl about his age. He was just a common farm dog, whose maternal parent had been a proud collie, but whose paternal antecedents were absolutely unknown.

Arriving at the farm in a few minutes, we found the little girl crying and Bowser having one spasm after another. He had evidently picked up some strychnine.

After receiving a tenth of apomorphine, he soon emptied his stomach, and then was given two grains of phenobarbital. We left an ounce of elixir lactated pepsin to be given in teaspoonful doses later. Giving Bowser a farewell pat on the head, we told our client there would be no charge for the call, as it would be given to him as a present.

The next morning, the owner called up and said:

"Well, Doc, Bowser is almost as good as new. You gave him the best Christmas gift he will ever get—his life. Thanks for all of us."

E. T. BAKER

Moscow, Idaho

The Control of Avian Coccidiosis

By CLIFF D. CARPENTER,* Fort Wayne, Indiana

TWENTY-FIVE years ago coccidiosis was a new word to the poultry industry. Once research workers thought that "bloody diarrhea" (the first name given coccidiosis), was but another manifestation of pullorum disease. In 1915 the disease was recognized in a few scattered states. Little was known of the life history of the single-celled protozoan parasite, infectious in nature, which caused the disease.

Other early questions included the relationship of coccidiosis in fowls to turkeys. Again, were blackbirds, sparrows, and other wild birds susceptible to coccidiosis, and if so, was the pathogen identical with that of chickens and turkeys?

Scientific workers have shown that there are seven species of coccidia affecting the fowl, each of which produces its own type of coccidiosis. Fortunately, some species do not produce serious effects on chicks, growing pullets, or adult birds.

In turkeys, two species of coccidia have been identified, neither of which is transmissible to chickens. The reverse is likewise true; not one of the recognized seven species of chicken coccidia—*E. tenella, E. maxima, E. necatrix, E. praecox, E. acervulina, E. mitis,* and *E. hagani*—is transmissible to turkeys. The practitioner must not overlook, however, the possibility of chickens becoming mechanical carriers of the sporulated oocysts of *E. meleagridis* and *E. meleagrimitis,* the two recognized species of turkey coccidia; and of course turkeys may become mechanical carriers of any one of the seven species of chicken coccidia. Similarly, wild birds have their own species of coccidia, but they, too, may become a mechanical means of spreading chicken coccidia, by carrying on their feet and feathers the sporulated oocysts from one chicken or turkey yard to another.

What Happens

When chickens or turkeys consume but a small number of sporulated oocysts, nothing serious happens. In fact, relatively small numbers, from one thousand to four thousand, actually establish a kind of immunity or resistance against later infections involving many thousands. The explanation of why and how this phenomenon occurs is just as obscure to the scientist as is a satisfactory explanation of the possible physiochemical changes which occur within the animal body following recovery from an invasion of germs or viruses.

The existence of this type of immunity goes far in establishing for the practitioner, as well as for the investigator, the reason why, even in an acute outbreak, the mortality often represents but a small fraction of the whole brood or flock.

When these tiny parasite eggs are swallowed in large numbers, they hatch out in the digestive tract and burrow into the lining of the intestine, the area depending upon the particular species ingested. Once the intestinal tract has been invaded thus, the next stage in the development of the parasite is produced in tremendous numbers, with the result that small blood vessels of the intestinal wall are ruptured.

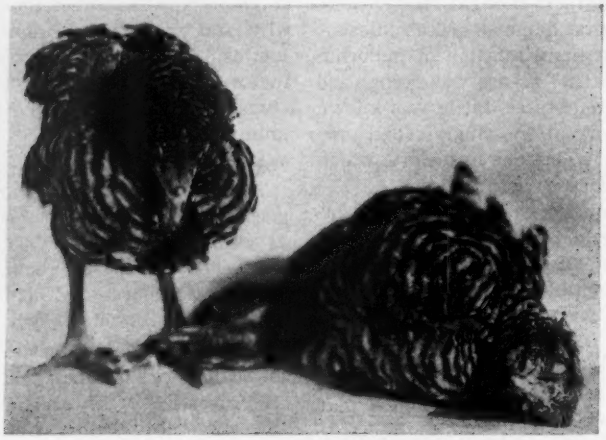
Cecal Coccidiosis

The most common species of coccidia seen on the poultry farm is *E. tenella,* the etiological agent of what is often called cecal coccidiosis, in which the parasite attacks, primarily, the lining of the ceca or blind pouches. If large numbers have been ingested within a short period of time, fatal hemorrhage usually occurs five days later. The droppings contain masses of uncoagulated blood a few hours prior to death, but in the beginning this symptom often escapes the owner's notice. In such a case the history of the attack usually discloses that the birds are from four to eight weeks of age, and that about a week prior to the onset they have been allowed to run out of doors on soil used the year before. Experimentally infected chicks show no clinical evidence of the disease for 96 hours following inoculation. During this incubation period, however, many changes are taking place within the host. Each embryonated oocyst is pro-

* Pathologist, Allied Mills, Inc., Chicago, Ill.

tected by a double-walled covering which yields to the action of digestive juices, plus the activity of the four single-walled sporocysts within.

Upon being released, which takes but a few minutes to an hour, each of the eight sporozoites (two in each sporocyst) progresses the length of the small intestine and gains entrance to the ceca. They never attack the duodenum or jejunum, and seldom attack the ileum, although they sometimes invade the submucous tissues in the region of the ileocecal valve.



Chickens suffering from Coccidiosis.—*Photo courtesy of Robert Graham*

In the majority of field cases, the onset of the disease is slower. The client's first warning may be that 10% or more of the brood become pale, appear sleepy, have rough feathers, and lose interest in eating. Bloody droppings may or may not be noted. This disease may have been present in the flock from five to ten days without an alarming mortality, simply because none of the chicks consumed enough coccidia to cause fatal hemorrhage, but only enough to make them sick and produce inappetence.

Necropsy Findings.—At necropsy, if the chick has died from fatal hemorrhage, every tissue appears normal, except that the ceca contain unclotted blood, or a semi-solid bloody mass. A blood count will reveal a serious reduction of the erythrocytes.

When chicks appear unthrifty, as the result of ingesting a sublethal number of coccidia, macroscopic evidence of the disease may be found in the ceca at necropsy. Seldom, however, do they disclose the same bloody mass as in the acute, fatal cases. A solid or semi-solid mass, often referred to as a cecal plug, discloses upon cross-sectioning alternate reddish-brown and grayish-white concentric layers. Obviously, the darker colors are the result of slight hemorrhages. The lighter areas are coagulated mucous deposits, produced by increased activity of the mucous glands in the cecal walls.

In a sub-fatal dosage it has been found experimentally that these cecal plugs are formed on the 8th or 9th day following inoculation. Often a cecal plug is expelled on the 9th or 10th day. If, however, its size will not permit passage through the ileocecal valve, the plug remains in the cecum and is disclosed on necropsy, perhaps several weeks following the attack.

Pullet Coccidiosis

Coccidiosis caused by *E. necatrix, E. praecox,* or other intestinal species, may appear in growing pullets, independent of a previous attack of *E. tenella* while in the brooder house. After experiencing the loss of several pullets, one may find on necropsy that the duodenum contains large masses of

blood. In these cases the intestine appears ballooned, the walls very thin, and close examination, without opening the intestine, may reveal small white foci in the wall about 1mm in diameter.

Originally called chronic coccidiosis, this intestinal form, produced by the consumption of large numbers of *E. necatrix*, may be just as acute as the cecal.

Some species of coccidia attack other parts of the small intestine, leaving as the only clinical evidence of the disease an unthrifty pullet. At necropsy, certain areas of the intestine may be thickened, and small hemorrhagic areas noted, but a laboratory examination is required for positive identification.

There is no cross-immunity between species of chicken coccidia. Recovery from an attack of *E. tenella* in no way confers resistance upon the same bird, against *E. necatrix* or other species.

Diet and Sanitation Important

Coccidiosis in all its forms is best controlled by brooding chicks and rearing pullets in a clean environment, and encouraging feed consumption during an attack. The sanitation program includes a clean, dry litter and floor. If the brooder house is movable, the chicks should be brooded on ground where no poultry has been raised for the two preceding years. Otherwise the ground may contain live, though dormant, forms of the parasite. If the house is not movable, alternate yards should be provided from year to year.

Likewise, pullets should run on clean ranges, not using the same range year after year without rotation. Nor should poultry droppings be used as a fertilizer where chickens are to be raised.

In whatever form the disease appears, regardless of age, some form of milk should be used at once. The milk in itself is not a specific, and the early belief that coccidiosis could be avoided by feeding large quantities of milk, has been exploded long since. Used judiciously, however, milk serves as an appetizer, and, since lactose appeals to their taste, is the finest type of nursing food to help the chicks weather an attack.

With the average attack of coccidiosis, more birds starve to death than bleed to death. Now, since the disease runs its normal course in a few days, it can be seen that if the birds can be kept eating, the percentage of recovery will be high in all cases except in those which consumed lethal numbers of coccidia. Since dried cheese whey is richer in milk sugars than any other form of milk, this product has proved to be a most valuable one in controlling this disease.

Dried skim milk, dried buttermilk, condensed buttermilk, and condensed whey have been used by poultrymen with good results. It is important that high protein milk mashes not be used excessively. The high level of protein stimulates growth artificially, and seriously damages the kidneys.

The dried cheese whey mash should be used for one day when the disease is first noted; the next day the brooder house should be cleaned thoroughly and the litter renewed. The whey mash may be used on alternate days for decreasing lengths of time, until the birds are through the attack. After the first cleaning, it is usually necessary to renew the litter only if it is damp.

Coccidiosis Tomorrow

Recent experimentation has shown that several forms of sulphur, such as flowers of sulphur, sulphur flour, and colloidal sulphur, are quite specific in *preventing* cecal coccidiosis. Unfortunately, a form of rickets may accompany the use of too much sulphur. Although there is evidence that some of these products may prove to be of considerable assistance, more research and a large number of trials under practical conditions are needed before a broad recommendation can be made for the use of sulphur in preventing coccidiosis.

The successful poultryman has learned to live with coccidiosis. While this disease may always be with us, it can be predicted that losses will decrease each year, as it becomes more widely understood that light attacks confer resistance against later fatal attacks; that the disease runs a limited course, regardless of the methods used to treat an outbreak; and that losses depend upon two factors: the numbers of coccidia ingested, and the total amount of proper food eaten during the attack.

A Practitioner's Experience With Milk Fever

By S. L. STEWART,
Olathe, Kansas

MILK FEVER in dairy cattle is an ever-increasing affliction in most heavy dairying sections. It is of common occurrence in some sections and rare in others; but common or rare, it appears to be increasing in frequency everywhere. The rapid development of high producing dairy cows has brought about a tremendous increase in some of their ailments, especially ailments of the udder and milk fever. The dairy cows of today are physically stronger than they ever were, but the demands upon them have increased even more than their capacity. The old-time cow could produce only a little more than enough milk to feed her calf. The modern dairy cow must produce from four to 12 gallons a day. Her year-around ration and care are frequently inadequate to tide high-producing cows, or at least some of them, over the critical periods of gestation, parturition and lactation.

Notwithstanding the rapid progress that veterinary medicine has made in the last half-century, notwithstanding the brilliant veterinary research of that period and the many important discoveries, and far-reaching elucidation of animal disease problems, milk fever is almost as much of an enigma today as it was in 1890, before Schmidt of Kolding or Greig of Edinburgh were ever heard of on this side of the Atlantic.

Some are satisfied with the statement that milk fever is caused by a lack of calcium in the blood. The theory is supported by the fact that the calcium level in the blood is low during attacks and rises promptly from treatment in cases that recover. It is impaired by the circumstance that a far greater number of cows suffer a low blood calcium level without developing the disease. Even if one accepts hypocalcemia as the cause, one is immediately confronted with another unknown—what causes the hypocalcemia? Where one cow has milk fever, why do her barn mates, similarly bred, fed and handled, escape it? Granted a heavy flow of milk, growth of the fetus and the production of colostrum is a heavy drain upon the calcium resources of the body, the hypocalcemia cannot be a result of an absolute lack of calcium or udder inflation could not remedy it, nor could the, by comparison, minute amount in a calcium gluconate injection relieve it. To say that the hypocalcemia is due to parathyroid dysfunction is to enter the field of pure speculation and pose another unknown. Why is not the calcium mobilized where it is needed?

■ Pages might be filled with the various theories advanced to explain the etiology and pathology of milk fever, but no useful purpose would be served by such discussion except to show the inapplicability of names that have been given to it; and that can be done more briefly. Let us consider some of the more common:

1. Milk fever
2. Parturient paresis
3. Hypocalcemia
4. Coma
5. Faint

The first name, milk fever, is quite nonsensical. There is no fever (the cow is usually cold) and if there were fever it would be the cow, not the milk, that had it. Parturient paresis is inapplicable since there is no paralysis. Hypocalcemia is an effect, not the disease. Coma, likewise an effect, is common to many ailments. Faint, although somewhat descriptive, has found little favor, probably because we are disinclined to regard the malady as primarily nervous and secondarily a circulatory derangement. With the cause and the pathology unknown and the lesions as yet undiscovered, it may be

just as well to adhere to the name given it when fever, like distemper, meant an illness. Milk fever at least possesses the merit of being understood by doctor and layman alike. And that completes the cycle in that particular discussion, bringing us comfortably to the point of departure. It is a characteristic of milk fever discussions to go around and around. But even so some fallacies may be thrown out by centrifugalization, and that helps. I'm a firm believer in the value of clinical observation in the solution of disease problems. The weakness of that method is the large amount of clinical observation it takes to separate the sound from the spurious and the woeful neglect of practitioners in the matter of recording their experiences and thus building up a mass of data which may be studied and evaluated.

■ In 1895 Schmidt, a Danish veterinarian, injected a 1% solution of potassium iodide into the udder and cured many cases. Klusel in 1902 inflated the udder with air with better results. A few years later oxygen was used for the inflation. The cures with oxygen were as frequent as with air and less udder infection resulted. The use of oxygen for inflation became quite popular but in time was almost wholly superseded by air. Of course neither air nor oxygen increased the amount of calcium in the body, but the amount in the blood was in some manner increased. The beneficial effect of ballooning the udder and forcing the blood within it back into the general circulation may be explained on the theory that it thus raised the blood pressure and overcame the brain anemia which exists in milk fever. This theory as to why inflation of the udder usually brings about recovery in attacks of milk fever has never been disproved. Likewise it hasn't been proved.

The blood pressure varies tremendously in milk fever. In some cases it is almost nil, in others it may be nearly normal. The higher the blood pressure when the cow is treated, the more sure the response. Whether there is a variation in the blood pressure before symptoms of milk fever are shown has not so far as I know been determined.

It seems that the more milk a cow produces, the more likely she is to have an attack of milk fever, perhaps because the enormous udders of high producers afford a greater place for blood to accumulate than do the udders of low milk producers. When milk secretions suddenly cease the blood vessels within these great udders and the superficial abdominal veins have the capacity to hold a very considerable portion of the entire amount of blood in the body, thus contributing to low blood pressure, and an anemia of the brain. Superimposed upon this influence is that of profound circulatory disturbance due to the emptying of the uterus.

Illustrative Clinical Reports

Case No. 1, Oct. 10, 1940.—A good grade Guernsey cow calved in the pasture during the night. She was found down and showing typical symptoms of milk fever with a fairly good blood pressure. She was treated at 8 a. m. and soon got up, but went down again in a short time. She was retreated at noon, the afterbirth removed and the inside of the uterus massaged to stimulate contraction. She did not get up again and died at 8 p. m. the same day.

This case is worthy of careful consideration. At first the cow showed only typical symptoms of milk fever. She responded to treatment and rose, but went down again in 30 minutes. At noon she was still down and was treated the second time, the afterbirth removed, the inside of the uterus massaged without noticeable response. At 7 p. m. she was almost completely comatose and showed a different line of symptoms, with her eyes

Milk fever, an ever-increasing affliction in most heavy dairying sections, is almost as much of an enigma today as it was in 1890.

almost closed and the body temperature very low, so that she was clammy cold to the touch. She had scoured all afternoon, evacuating a tremendous amount of thin,

Milk Fever.—*Photo by Baker*

bloody feces, and looked as though she were dying from autointoxication. Of course, one cannot disregard the excessive loss of body fluid and the effect that may have had upon the circulation. It might not be farfetched to ascribe death to circulatory disturbance incident to dehydration.

Case No. 2, Oct. 10, 1940.—This case occurred the same morning as case No. 1, but seven miles distant. A good grade Holstein cow was found down in the pasture with a newborn calf. She showed all the symptoms of a typical case of milk fever with a low blood pressure. The symptoms, treatment, and response to treatment tallied closely with those of the first case, and she died in about the same length of time.

Case No. 3, Oct. 12, 1940.—A good grade Jersey cow was found down at 2 p.m. in the pasture. She appeared almost dead, although her blood pressure was extra good. She was given the same treatment as in the first two cases. Before the intravenous apparatus was washed, she got up and beat us to the barn a quarter of a mile away.

Case No. 4, Nov. 20, 1940.—A good grade Jersey cow was found down in the snow out in the pasture. She appeared to be in very poor condition, and was very comatose, but she had an extra good blood pressure. She was given the usual treatment and recovered so quickly in a fighting mood that she put three of us over the fence out of the pasture minus the medicine case and most of the other paraphernalia. She claimed the calf and the pasture too, and we did not contest her right of possession.

Case No. 5, Nov. 22, 1940.—A red shorthorn cow kept in a cold, wet stable went down the second night after calving, and was seen the next morning—the third day after calving. She was very comatose and badly bloated, but had a good blood pressure. She was so badly bloated that the first step in treatment was to use the trocar to relieve the gas pressure. She was then treated for milk fever, the afterbirth removed, and the inside of the uterus massaged. Within a few minutes she got up and began to eat hay. The uterus in this cow was unusually large and flabby, containing much fluid and a large afterbirth. She caused no more trouble and in less than a week was giving a normal flow of milk.

Case No. 6, Nov. 22, 1940.—A large Holstein cow in labor staggered around and finally fell with her rear jammed into a corner of the barn. She had quit laboring and could not be induced to move. When I arrived she looked as if she would die before she could be treated. In addition to the throes of parturition she showed typical symptoms of milk fever, and was therefore treated for that ailment. By the time we were ready to pull her out of the corner with a triple block she rose, walked to the other end of the barn, and I delivered her calf for her. She seemed to be in splendid condition and was soon eating hay, causing no more trouble.

Case No. 7, May 1, 1940.—This cow was bought for $1,000, shipped several hundred miles, and calved on the night she arrived at the farm. The weather was cold and very muggy, but she was in a good barn. The next morning she was found down with milk fever, but was standing up staggering around when I arrived. Her blood pressure was unusually low. She was treated for milk fever and the afterbirth was removed, but before the job was completed she went down and lay there quietly. After being placed in proper position on her belly and sternum, she seemed to be in good condition. She was treated again at noon, and again that evening, but from that time on she did not seem to make any progress. She seemed at ease and in perfect comfort all the time, ate plenty and drank well. At the end of 60 days the owner had her destroyed.

Case No. 8, Dec. 10, 1940.—A good, large Guernsey cow, a very heavy milker that had calved eight months previously and had been pregnant for five months, was found down in the big feed barn at milking time, 3 a.m. Upon my arrival she was showing all the symptoms of a typical case of milk fever. She was given the usual treatment and in less than 30 minutes she got up and walked into the dairy barn and began eating her breakfast, completely cured. No relapse followed.

Case No. 9, Dec. 11, 1940.—A poor type grade two-year-old Holstein heifer had been milking

about five or six months. She was staggering around at milking time in the evening, and was placed in the stanchion with some difficulty. Upon my arrival she was staggering from one side to the other as if about to go down, her eyes staring and saliva drooling from her mouth, and jiggling her nose on the feed box and stanchion. She was given the usual milk fever treatment, and was completely recovered the next morning.

Case No. 10, Dec. 11, 1940.—A very poor type 2½-year-old Hereford heifer was down all night. When seen the next morning she evidenced all the symptoms of milk fever, with an unusually low blood pressure. Her blood pressure was so low that the blood would not run from the jugular through a 14-gauge bleeding needle. She was given the usual milk fever treatment, but died before noon that day.

■ Summing up, an intravenous injection of 500cc of 23% calcium-boro-gluconate will bring about recovery in a very large percentage of all uncomplicated cases of milk fever—90% I should say. Such cases produce as much milk during the ensuing lactation period as they would have produced had they not suffered the attack. That is to say, recovery is wholly complete. It is cases that do not recover from the first treatment that worry us. Cases with an unusually low blood pressure or cases that look as if they may require a return trip are given a little different treatment. A heaping teaspoonful of table salt is added to the calcium-boro-gluconate solution, making a less than 2% solution of sodium chloride. This calcium gluconate-sodium chloride solution seems to give better results in this type of case than the gluconate alone. All cases of milk fever are given hypodermically one tablet of eserine compound No. 2, to stimulate the heart, raise arterial tension, and stimulate peristalsis and defecation. All cases that have a tendency toward ketosis are given a one-ounce dose of chloral hydrate in capsule, leaving with the owner a 500cc bottle of a 7% solution of chloral hydrate to be given in two-ounce doses every two hours. Chloral hydrate seems to be somewhat beneficial in acetonemia, but its value is generally overestimated. Those few cows that are down 24 to 36 hours after the first treatment are placed on stimulants, with the idea of stimulating the heart and raising blood pressure, and also improving the appetite and digestion.

The kind of care the cow gets is of much importance in the treatment of milk fever. She should be placed in a comfortable position, propped up on her belly and sternum, and held in this position by bales of straw, to allow for better breathing and better heart action, until she rises of her own accord. Further, the cow like all other ruminants bloats if she lies on her side very long. This bloating may force ingesta up into the throat and result in its being drawn into the lungs. If in deep coma, her head should be tied up in a normal position. It is very important that she be kept on her sternum.

It has been said a great many times that, with few exceptions, milk fever is an ailment of cows experiencing an easy or normal parturition, and does not come on after dystocia. In my experience the affliction has not occurred in serious dystocia, but retained afterbirth is a common concomitant, and eversion of the uterus by no means unknown. Neither condition can be considered a normal parturition.

Dr. E. T. Baker of Idaho has stated that milk fever is far more prevalent in muggy, murky weather than it is on clear days; i.e., a low barometer signalizes many calls for this ailment, a high barometer few such calls. My experience coincides exactly with that of Doctor Baker. I can offer no explanation for this climatic influence; but it exists.

Prophylactic measures seem to be of some little value. The following are indicated:

1. Lower the high protein feed several days before parturition.

2. Do not milk the cow for 12 to 24 hours after calving. Then do not milk the udder dry for two to three days longer. This seems to be very important.

3. The calf should be removed before sucking, as it will empty only one quarter, and the cow really needs all quarters strutted with milk for 12 to 24 hours after calving.

4. The cow should be watered properly and fed prairie hay or corn fodder and fed very sparingly on mill feed or other concentrates for several days after parturition.

A Few Timely Tips on Swine Practice*

The hog loves, demands, requires, and pays dividends upon comfort.

Hogs prefer shade to mudholes, but will lie in a wallow in preference to hot, dry ground where there is no shade. A straw-covered canopy, open on all sides, is easily constructed and makes a desirable shade for hog lots in which there are no shade trees.

Because of his insulation of fat the hog can stand cold well, but he dislikes intensely cold drafts, to which he is very sensitive. If the hog house is drafty the animals will move the bedding to any dead air spaces it may contain. If there are none, the hogs will pile up for warmth. Those at the bottom of the pile, becoming overheated and uncomfortable from pressure, crawl out and lie at the edges of the pile, where they become chilled and liable to respiratory ailments, a likelihood that is increased by the dust stirred up by this more or less continuous movement of a bunch of hogs sleeping in a cold, drafty hog house.

Farrowing pens covered with temporary straw lofts make desirable cold weather sleeping quarters for hogs. They can be closed up all around except the door and the loft will provide ample ventilation, the vitiated air escaping readily through the straw.

The hog will not willingly defecate or urinate in his bed or on straw on which he has slept. He prefers for his toilet a space of bare floor.

It is not only good practice but good business as well for the veterinarian to inform himself as to the swine husbandry practices on the farm where he is called to treat ailing swine. Often it is only after the correction of faulty practices that treatment of the sick animals becomes of any avail. It is useless to treat influenza or other respiratory affections without providing the animals a suitable place to sleep; it is a waste of time to treat diarrhea in young pigs without taking steps to prevent the sows from lying in hog wallows or other filth of that nature.

A grain ration exclusively is unsuited for any swine. It is particularly disastrous for brood sows. Corn is satisfactory for the pregnant sow if properly supplemented with legume hay or pasture, tankage or dairy by-products. Oats and barley have less feeding value than corn, pound for pound, but are often preferable to corn for the sow that is suckling a litter of pigs. Clean water, not too cold, and salt, preferably iodized salt, should be constantly available to all swine. A mineral mixture is a desirable supplement for most rations.

Pregnant sows should be protected from colts, especially from young mules, and also from young bulls and old boars. Ingenuity should be employed to prevent pregnant

*Excerpts from an address by John B. Bryant, Mount Vernon, Ia., at the 26th Annual Meeting of the Wisconsin Veterinary Medical Association, Madison, Wis., January 8-9, 1941.

sows from slipping and from rough handling. A very large number of litters are lost every year from easily preventable cases of injury which result in abortions or death of the fetuses. The pregnant sow should not be cast for restraint, but snubbed to a post in the standing position. And she must have exercise to do well, for herself and her young.

Milk appears in the teats of the pregnant sow about three days before farrowing time. During this period the regular ration should be reduced one-half and bran in amount to one-third of the reduced concentrate ration given. It is laxative and helps to prevent irritability and agalactia. Two or three days before farrowing the sow should be moved to the farrowing pen which should have been thoroughly cleaned two or three weeks earlier. When the sow is put in it the farrowing pen should be well bedded with short straw or chaff. It pays to scrub the sow well with warm water and plenty of soap when she is transferred from the hog lot to the farrowing pen.

As the pigs are born they should be rubbed briskly with straw, but the navel cord should not be broken or the pulsation in it stopped by compression until the pig begins to breathe. The pig should be placed in a basket (containing a hot brick for warmth if the weather is cold) and kept away from the sow until farrowing is complete. When returned to the sow each pig should be helped to get hold of a teat and begin sucking. If a sow farrows more pigs than she has functioning teats the excess pigs may be transferred to smaller litters differing in age not more than a day. In so doing the pigs transferred and those already in the litter should be wiped all over with a cloth moistened in kerosene; thus all will smell alike and the sow will not discover that any are not her own.

The parturient sow should receive only water for 24 hours after farrowing. She should then be fed whole oats in small amounts, gradually adding proteins and other feeds for 10 days, at which time she should be on full milk producing ration. Scour in pigs during the first 10 days of life usually indicates dietary errors in feeding the sow—commonly overfeeding, particularly with proteins. The diet should be corrected and the sow given in addition a tablespoonful of the following mixture three times daily: triple sulphocarbolates, catechu and prepared chalk of each one pound, powdered ginger one-half pound.

Pig anemia is prevented by access to the soil, or in winter when the pigs are confined, by mixing a pound of iron sulphate and a half-ounce of copper sulphate in 30 pounds of earth from a pasture or field not recently occupied by swine and allowing the pigs access to it. Wounds about the face (from fighting) should be treated promptly with an antiseptic wound oil, wounds, ulcers or sores inside the mouth should be touched with tincture of iodine. Pigs should be vaccinated at seven to eight weeks of age and weaned at 9 to 10 weeks. In vaccinating the pigs the virus should be injected into the median surface of the ham and the serum into the peritoneal cavity. Cholera occurring more than three weeks after vaccination can mean only that dead virus was used, and the chances are it was the fault of the veterinarian. Virus must be refrigerated every minute from the time it is received until it is used. Store it in a refrigerator, carry it to the farm in an insulated box containing ice. Never let it warm up at all until after it is injected into the hog. Hogs should receive no tankage for three weeks after vaccination; vegetable proteins, however, are not objectionable. Oats should be substituted for a part of the corn for the first 12 days after vaccination. Avoid vaccination if latent pulmonary or enteric infections are suspected.

It is not only good practice but good business as well for the veterinarian to inform himself as to the swine husbandry practices on the farm where he is called to treat ailing swine. Often it is only after the correction of faulty practices that treatment of the sick animals becomes of any avail.

A New Treatment for Internal Parasites of Sheep

The stomach worm and the tapeworm of sheep are so often associated that simultaneous treatment has become widespread. In view of the toxic effects of repeated copper sulphate treatment, an attempt was made to investigate, from the practical angle, a new chemotherapeutic agent which is widely used as an anthelmintic in dogs and horses.

Normal butyl chloride has been found to be effective for roundworms, hookworms and whipworms of dogs and for strongyles of horses. Harwood et al[1] have shown its comparative non-toxicity for dogs as compared with other organic synthetics and with oil of chenopodium.

Since no reference to the action of this chemical on sheep was readily available in the literature, a small dosage was used.

Ributyl capsules were employed. This capsule contains 3cc normal-butyl chloride and ¼ grain phenolphthalein. (The presence of the small amount of laxative perhaps accounts for the fact that no toxemias were observed despite the fact that the sheep were not given a saline laxative after the ributyl was administered.)

A flock of 17 lambs averaging about 50 pounds was heavily parasitized and in poor condition. The common stomach worm (*Haemonchus contortus*) as well as the nodular worm (*Oesophagostoma columbianum*) were identified. One ributyl capsule was administered to each animal. No irritation or straining was observed. Six days later the lambs showed great improvement; not only were they free from worms, but the general physical condition was greatly improved.

Another flock of 22 sheep, all of them heavily infested with *Haemonchus contortus,* was given one ributyl capsule each every two weeks for two months; not only were no toxic symptoms observed, but the animals, which were in very poor condition when they came under my observation, improved decidedly within one week after the first treatment. The capsules were well tolerated and no coloring of the urine or offensive odor was noticed.

Other cases of sheep treated with ributyl confirmed the favorable impression of this product as a sheep anthelmintic.

In view of the many disadvantages of phenothiazine, such as high dosage, red coloring of wool by the urine, and danger of secondary anemia and leucocytosis, I believe that it would be well worth while to study further the effectiveness for sheep of this newer, apparently less toxic anthelmintic.

N. J. EDER

Wapokoneta, O.

[1] Harwood et al., 1940. *No. Am. Vet.*, 21:1, p. 35.

* * * *

Pregnancy Disease in a Ewe

Pregnancy disease is a toxemia of advanced pregnancy characterized by a paralysis and convulsions, high mortality, fatty degeneration of the liver and ketonuria. It is very common in ewes bearing twin lambs.

It is called also acidosis, acetonemia, pregnancy toxemia, ketonuria, stercoremia, etc.

History.—January 28, 1941, a four-year-old Corriedale ewe was presented for treatment at the veterinary clinic of Kansas State College. This ewe came from a flock of 87 Corriedale sheep that had been on a lambing diet all winter. Feed for the flock

The Corriedale ewe described in this report, with her two healthy lambs

consisted of one pound of 50% barley and 50% rye supplemented with cottonseed cake, steamed bone meal and salt. Three ewes had already died, one after having been treated with 250cc of 25% dextrose intravenously. The owner was then instructed to feed alfalfa hay as the only roughage and to haul it one-half mile from the barn so the flock would get exercise. Ground corn was substituted for the rye and barley. In spite of these measures, another ewe, the subject of this report, became sick two weeks later.

Symptoms.—The first symptoms observed consisted of listlessness and anorexia, followed by staggering and finally by paralysis of the hind legs, the animal going down. Grinding of the teeth was noted. The urine reacted strongly to the Ross test for ketone bodies. The temperature was slightly elevated and the respirations were slightly increased.

Diagnosis.—Pregnancy disease.

Prognosis.—Guarded.

Treatment.—When the animal was first presented for treatment, 500cc of 25% dextrose was given intravenously. The next morning, she was up and able to walk a little. She ate a small amount of alfalfa hay and a small amount of corn, oats, and bran chop. The urine was still positive to the Ross test. Daily treatment for six days consisted of 250cc of 25% dextrose intravenously, and the ewe was exercised twice daily. A total of 3,500cc of 25% dextrose was administered. The ewe reacted to the Ross test daily, even to the second day after parturition.

Parturition was completed in the normal manner on the seventh day after treatment was started, the ewe having two normal lambs. Dextrose therapy was discontinued after parturition and the ewe was fed alfalfa hay and corn, oats, and bran chop.

Conclusions.—From the results of this and a previous case, it is suggested that 25% dextrose is very beneficial in pregnancy disease only if larger amounts of it are given than are normally used. Daily exercise for the ewe is also very important in these cases.

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Epsom Salt Poisoning in Cows

Some years ago I was called to see a cow that was six months pregnant. From the symptoms I diagnosed the trouble as atony of the rumen and gave a drench of one and one-half pounds of epsom salt with carminatives.

The cow, which had been walking around perfectly strong until then, was down in 30 minutes in the milk fever attitude. Not knowing what else to do, I inflated her udder, udder inflation being the only treatment we knew for milk fever at that time. She responded in about an hour, getting to her feet and recovering uneventfully.

Since then I have had many cases where the history was that a dose of epsom salt had been given a short time previously to a cow that had just calved or was just about to calve, or in some cases several months after calving. They are down and unable to rise; some have their heads up, others are in the milk fever attitude. All have a subnormal temperature. All respond to the calcium gluconate treatment in a few minutes and make an uneventful recovery.

In our community epsom salt is given by the dairymen for almost everything that ails a cow. I am sure that under certain conditions it knocks a cow off her feet. I am also convinced that it can cause a relapse in mik fever cases, and that an animal which has been drenched with it before the veterinarian is called will not respond so readily to the calcium treatment, and is more prone to relapse.

Epsom salt is a good medicine if it works, but in my opinion it is a mistake to give it for impaction of the stomach. It affects the appetite, rumination, and normal thirst until after catharsis occurs, so that if it fails in its cathartic effect the animal does not drink and is in a much worse condition than before.

Epsom salt lowers the calcium content of the blood, so that giving it in cases of milk fever is like turning off the hydrant to get more water in the bucket. Further, it is a sedative and narcotic if absorbed, which also has a bad effect in milk fever.

R. H. SMITH.
Lewisburg, Tenn.

Abstracts

Fat as a Factor in the Healing of Rickets

A rachitogenic diet was devised which is made up largely of purified materials and which is low in lipids. In experiments with rats,[74] addition of 5% of fat to the rachitogenic diet gave a much better healing with a known amount of vitamin D than with no fat in the diet. With the addition of 10% or 20% of fat, the healing of rickets was less than with 5%, but greater than was obtained with no fat. Replacement of all the calcium carbonate in the diet by an equivalent amount of calcium in the form of an oleate or stearate, resulted in better healing. Replacement of only one-fourth of the calcium carbonate by an equivalent amount of calcium in the form of an oleate or stearate did not result in any appreciable difference in the healing with vitamin D.

* * * *

Treatment of Heartworm with Fuadin and Sulfanilamide

In an attempt to find a safer, more efficient and more economical treatment for the dog heartworm *(Dirofilaria immitis)* than the use of fuadin alone, the possibility of a synergistic action between this drug and sulfanilamide was investigated.[73] Various doses and combinations of these two drugs were tried. The combined fuadin-sulfanilamide course of treatment over 10 days resulted in the elimination of microfilariae from the blood stream of five of six dogs. The sixth dog had its microfilaria count reduced 96%. Four of the dogs, weighing 11 to 15 kilograms, were given 1.0cc of fuadin daily in a single dose intramuscularly for the first four days and 1.5cc for the last six days. The remaining two dogs, weighing 20 kilograms each, were given 1.5cc of fuadin daily for the first four days and 2.0cc for the last six days. The sulfanilamide dosage was four to five grains per kilogram weight of dog, and was divided into two doses daily by mouth. Three of the dogs suffered from reactions characterized by moderate fever, loss of appetite, bilateral corneal opacity and malaise. These reactions persisted for several days, but were not considered to be of sufficient severity to necessitate withdrawal of the drugs.

* * * *

Sulfanilamide in the Therapy of Actinomycosis

Chemotherapeutic successes in the field of bacterial and protozoal infections have not yet been equaled in the virus or fungus groups, but recent experience with sulfanilamide in the treatment of actinomycosis in man indicates that this remarkable drug may bring about recovery from the ray fungus as dramatic as from certain of the bacterial infections.[75]

Sodium iodide, or rather potassium iodide (physicians commonly use the old salt), is nowhere the specific for actinomycosis in man that it is in cattle. Goode in 1931 reported 62 cases treated with potassium iodide, radium or roentgen irradiation, and general supportive measures. Only eight (13%) recovered. That appears to have been about the average rate of success in the treatment of this disease.

Since 1938, seven clinical reports, comprising 11 cases of actinomycosis that were treated with sulfanilamide, have been published. Of these 10 (91%) recovered. These cases included three infections of the jaw; two of the appendix; two other abdominal infections; one infection each of the neck and breast; and one (the fatal one) of the jaw, face, and meninges of the brain. In most instances they were treated with iodides and irradiation until an unsuccessful outcome was apparent before sulfanilamide was employed. The authors are undecided whether sulfanilamide is antagonistic to the ray fungus or whether the improvement in the cases was due to its inhibitory effect on the streptococcal secondary infections, but are inclined to believe the latter is probably correct. They therefore recommend that iodides be used in conjunction with the sulfanilamide or at least as a sup-

[74] Knudson, Arthur, and Robert J. Floody, 1940. Fat as a factor in the healing of rickets with vitamin D. *Jnl. of Nutrition* 20:10, p. 317.

[73] Brown, H. W., and A. J. Sheldon, 1940. Treatment of canine heartworm *(Dirofilaria immitis)* with fuadin and sulfanilamide. *Jnl. Parasit.* 26:6 (suppl.), pp. 19-20.

[75] Dobson, Leonard, Emile Holman, and Windsor Cutting, 1941. Sulfanilamide in the therapy of actinomycosis. J.A.M.A. 116:4, pp. 272-275.

plement to it in cases that are slow to respond to the new treatment.

Since occasional cases in cattle and more frequent cases in the horses and in swine fail to respond to intravenous injections of sodium iodide, veterinarians may have occasion to supplement their treatment with sulfanilamide.

* * * *

Concentrated Blood Plasma for Shock

Members of the staff of Baylor University College of Medicine, Dallas, Texas, have been using desiccated plasma as a substitute for blood transfusions over a period of one and one-half years, and during this period have used the plasma from a quarter of a million cc of blood in about 200 patients. They find it much superior to whole blood for the treatment of shock and other conditions for which transfusion is commonly employed. The dried plasma is redissolved for use.

The advantages of desiccated plasma over whole blood are both technical and therapeutic. The dried plasma is simple to prepare, easy to keep indefinitely, and convenient to use. Therapeutically its advantages are many. It may be used at four or five times the concentration in which it normally occurs in the blood. In shock, for example, larger amounts of protein can be more speedily placed in the circulation than by any other method. It tends to cause an immediate reversal of the physiologic changes of shock. Blood volume is built up by immediate withdrawal from the tissues of fluids previously lost from the blood stream. Further, concentrated plasma seems to have a direct stimulating effect on vascular tone and permeability.

In hypoproteinemia following surgical operations it constitutes a highly desirable type of intravenous feeding, being an ideal food for all cellular protein requirements and important in the production of antibodies.

For military use it possesses the advantages of small bulk, perfect storage, simplicity and ease of use, and swift results.

[75] Hill, J. M., E. E. Muirhead, C. T. Ashworth, and W. D. Tigertt, 1941. The use of desiccated plasma, with particular reference to shock. *J.A.M.A.* 116:5, pp. 305-402.

The Carotene Content of Forage Crops

An increasing tonnage of various forage crops is being preserved by the ensiling process.[76] If information as to at what stage of growth these crops contain the greatest amount of carotene were available, it might be possible to ensile certain crops when the carotene content is high. A high carotene roughage is especially desirable in feeding dairy cattle in order to produce a milk of high vitamin A content.

Virtanen and co-workers reported that the total quantity of carotene of a plant increased rapidly up to the time of blooming and then diminished as the plant matured. Hauge found that young alfalfa, 10 to 12 inches high, contained almost twice as much vitamin A as did the alfalfa in full bloom. Hilton, Hauge and Wilbur stated that young alfalfa, 10 to 12 inches high, contained 90 units of vitamin A per gram but in the bloom stage it contained only 70 units. They also noted that soy beans, 12 to 15 inches high, contained 54 units of vitamin A, while the more mature plant, as cut for hay, contained only 30 units.

Myburgh found that the carotene content of pasture plants diminished rapidly as the plants matured or as they became dry during winter or during periods of drought. Smith and Stanley determined the vitamin A value of grama grass at different stages of growth. They noted that a sample collected August 2 was a very potent source of vitamin A, by September 20 it was only one-half as rich, and when sampled in November, 100 times as much of the grass was required to produce the same rate of gain in rats as that cut in August.

Atkeson determined the carotene content of each of 13 pasture plants three or four times during the growing season, and observed that the plants were relatively high in carotene during the early summer, although there was considerable variation. Carotene decreased during the hot summer months, but after the fall rains most plants reestablished their carotene content simi-

[76] Snyder, W. W., and L. A. Moore, 1940. The carotene content of several herbages during the growing season. *Jnl. Dairy Sci.* 23:5, pp. 363-371.

lar to early summer values. Big blue stem and buffalo grass were notable exceptions in that they showed a decrease as the season progressed.

Esselen and co-workers found that the vitamin A content of the maize plant increased as the plant reached full growth, after which there was a marked loss of vitamin A.

Watkins studied the monthly variation in carotene content of black grama and mesa dropseed range grasses. His results indicate that rains which stimulate new growth also cause an increase in the carotene content of the grasses.

The authors undertook the study of alfalfa brome grass, corn leaves, oats, soy beans, white sweet clover, and Sudan grass. In most instances assays were made weekly from the time the plant started growth in the spring until it was harvested. The carotene was calculated in micrograms per gram of dry matter. Briefly, the findings were:

Alfalfa collected April 25th contained 432 micrograms of carotene per gram of dry matter. It decreased till the crop was cut for hay June 20th, when it was 171 micrograms. Seventeen days later the second crop assayed 318 and dropped to 132 when the second crop was cut. The third crop began at 367 and decreased to 284.

Brome grass began at 453 micrograms of carotene per gram of dry matter April 25th and decreased to 141 when it was cut for hay. The second crop ranged from 466 to 317.

At the time the tassels appeared, corn leaves contained 482 micrograms of carotene per gram of dry matter and 518 two weeks later, but when mature enough for husking had decreased to only 25. Oats when six inches high stood at 525, when harvested at 13; soy beans at 472 when the pods were developing, at 35 when the leaves were yellow. Sweet clover assayed 244 when 18 inches tall and only 126 when in full bloom.

Obviously for carotene content, the earlier a forage crop is harvested, the better. It was noticeable that the loss of carotene was particularly rapid when the plants began to flower and a few days earlier. These results suggest that hay crops might with advantage be cut about two weeks earlier than has heretofore been regarded as the best stage of the plant for harvesting for hay.

* * * *

Colitis in Horses Treated with Formalin

Twelve horses suffering from colic were given intravenous injections of a 10% formalin solution.[79] Eleven of them recovered after the first injection, and the other received a second injection 15 minutes later and recovered. Formalin seems to be very efficient in the treatment of colic in horses. It has an antispasmodic effect, relieves pain, and causes the expulsion of gas. Further, it is excellent for neutralizir ş the toxins originating in the intestine and absorbed into the blood stream.

* * * *

Acute Laminitis of Horses Treated with Aninsulin

The authors[80] carried out their experiments on horses of the French army stricken with acute lymphangitis following one or more wounds or abscesses. They called their new product "aninsulin," and obtained it by subjecting insulin under special conditions to the action of heat and of formol. They reached the following conclusions: Aninsulin has a trophic action. All the animals treated improved after the second and sometimes after the first injection of 1.25cc of aninsulin. Suppuration was dried up very quickly. The new product has healing effects on lymphangitis also; in some cases the first series of injections results in healing of the abscesses, but a second treatment was necessary for the lymphangitis. Treated horses had to stay in the hospital only 14 days, as compared with 40 days for the control animals. The Preisz-Nocard bacillus was not present in abscesses of many of the horses which were carefully examined.

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[79] Cremona, P., 1938. Sur le traitement des coliques du cheval par les injections intraveineuses de formol. *Profilassi*, July-August 1938, p. 129. Abst. in *Rec. de Med. Vet.* 95:7, p. 426.

[80] Barral, Pecasting and Dusserre, 1939. Traitement par l'aninsuline de chevaux atteints de lymphangite aigue avec absces. *Rec. de Med. Vet.* 95:6, p. 332.

Book Reviews

Diseases Transmitted from Animals to Man. *By Thomas G. Hull,* Ph.D., Director of the Scientific Exhibit of the American Medical Association. 2nd ed. Cloth bound. 403 pages, illustrated. Charles C. Thomas, Springfield, Ill., 1941. $5.50.

Soon after the discoveries of Pasteur and Koch in the nineteenth century, theses on the microbian infections common to man and animals began to appear in the literature. So many of them were written by veterinarians that the subject became somewhat hackneyed and remained the manifestly one-sided viewpoints of animal pathologists. The infectious diseases man contracts largely from animals were never dealt with as a group in medical literature until the first edition of this book was published in 1930—a date to set down as the beginning of the era of comparative pathology in this country, an era long sought by those clear-sighted enough to see the wisdom of developing a spirit of cooperation between human and animal medicine for their mutual benefit.

The second edition of this book became necessary through the normal advances made through medical and veterinary research during the past ten years. Diseases of this group hitherto unknown have been discovered, and new facts about the old list have come into the veterinary-medical picture. Chapters have been added on equine encephalomyelitis, encephalitis of sheep (louping ill), sore mouth of sheep, Rift Valley fever, typhus fever (Rickettsia diseases) and relapsing fever; and the chapters on psittacosis, fungous diseases and animal parasites have been entirely rewritten.

The value of this book rests upon its authenticity. The text of each chapter was modernized by men widely known as specialists on the subject concerned, among them Mohler on tuberculosis of animals, Kelser on rabies in animals, Huddleson on brucellosis, Meyer (Karl) on psittacosis, and Couch on milk sickness, to name but those closely identified with the veterinary service. Prominent figures in the U. S. Public Health Service revised such significant chapters as those on tularemia, botulism, plague, typhus fever, and Rocky Mountain spotted fever. All told there are 15 contributors. All are closely identified with current medical progress.

The subject is not a simple one. Its increasing ramifications show that only the combined knowledge and experience of scientists in both human and veterinary medicine suffice to clarify the many details previously unknown to one or the other. While the Committee on Communicable Disease once reported but 13 diseases primarily of animal origin, it now names 62 infections and infestations that are worthy of the mutual attention of the two professions. All factors capable of transmitting disease from animals to the human being, directly or indirectly, come within the scope of the subject.

Much as we as veterinarians pretend to know about this group of diseases, our knowledge of their manifestations in man has been surprisingly meager. While we may have been impatient at times with indifferent physicians who show no interest in the diseases his patients contract from animals, we too have been slow in acquiring a knowledge of man's reaction to the same contaminations. Comparative pathology has been a neglected study in schools of medicine—human and veterinary.

This work must be possessed and read to profit by its manifold, up to date contexts. Tabulated records compiled by expert statisticians of the U. S. Public Health Service; diagrams on the epidemiology of relapsing fever, Rickettsia diseases, psittacosis and brucellosis; and maps on Rocky Mountain spotted fever, typhus fever, bovine brucellosis, and tuberculosis of cattle and fowl give one a liberal education on the nature and prevalence of outstanding afflictions of man and his animal contacts.

The last section, entitled "A Review of the Rôle Played by Each Animal in the Spread of Disease" cannot be too highly praised. It is the whole text boiled down to 22 pages of factual material about the blame the epidemiologist pins upon the different species of animals in his ecological explorations.

Essentials of Nutrition. *By Henry C. Sherman and Caroline Sherman Lanford,* Columbia University. Cloth bound. 417 pages, illustrated. The Macmillan Company, New York, 1941. $3.30.

Up-to-date views on the essentials of nutrition are summarized in this work. As a summary, the treatise will be found quite sufficient for the casual student of the subject and should be approved by experts on nutrition and dietetics as a convenient reference or for a hurried survey. Its value rests with the care taken to avoid premature opinions on a subject, now in the adolescent stage, that can easily lead an unwary author into uncharted terrain.

The fact that boys and girls now entering the American colleges are taller for their age than were their parents is attributed to a better understanding of nutritional needs during the age of growth, not to any improvement in racial stock. Soon after the turn of the century biological chemists began to realize that the orthodox analyses of food were not the criterion in nutrition, and discoveries in recent years have greatly expanded the knowledge of food chemistry.

There is a difference between adequate and optimal nutrition and also between health in the accepted meaning of the word and the buoyant health which the food chemist is trying to create through "nutritional improvability." Passable health, or merely absence of disease, is to be replaced through chemistry with a biological exuberance hitherto unexperienced.

To be adequate food must (1) supply the body with fuel, (2) provide the material, and (3) furnish the regulating substances. This classification is a bit of condensed physiology that forecasts the authors' way of treating the subject. As a means of clarifying the approach to the whole subject of nutrition, this opening wedge is unique.

The book is arranged in chapters of short paragraphs, each containing a questionnaire useful for students and a bibliography of well-known authors. These chapters take the reader through a discussion of carbohydrates, fats, proteins, lipoids, digestion, metabolism, calories, heat regulation, measuring metabolism, energy needs, vitamins and mineral components of the food and body of the human being. The chapters on iron and iodine, giving the average intake of these elements, their bearing on nutrition and the daily elimination (in man) bring the present-day knowledge of these factors into a few pages of condensed material of considerable interest in human therapeutics. The table on the iron contained in common food materials is of great value. It shows the quantity per 100gm of fresh material, per 100gm of protein, and per each 3,000 calories, of 26 common foods. A study of this table shows clearly whence comes the iron of the human body. One looks to beef, eggs, peas, beans and prunes for iron, and to milk, potatoes, oats, carrots and wheat (in that descending order) for iodine.

The subject of vitamins is treated at considerable length and is seemingly a compilation of the known facts as of the beginning of 1940. The vitamins described which are new in veterinary literature are H, L_1, L_2 M, and P. The work of Patton on thiamin in dogs, of Green (R. G.) on Chastek paralysis in foxes, and the stimulating action of vitamin C in impotent bulls demonstrated by Elvehjem are not mentioned.

The chapter entitled "Some Relations of Food to the Teeth" reintroduces a subject of outstanding significance in both human and animal nutrition. Although the author does point out that teeth have become texturally deficient in comparison with those of primitive races, empirical rather than scientific evidence as to the cause of dental defects predominates. "Good health and good teeth go together," is the author's theme. In animals at least, this is an oversimplification. Avitaminoses A, C, and D are described in regard to their relation to dental caries. The atrophy of the tooth germ due to deficiency of A, the degeneration of the pulp due to deficiency of C, and the delay in dentition caused when D is lacking, is the combination responsible for decay of the teeth.

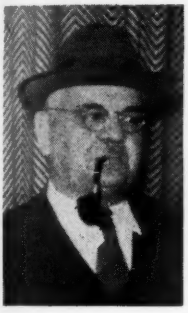
In the closing chapters the chief types of food are described as to their nutritional quality, cost, nutritional sufficiency, and their national and personal importance.

The appendices are particularly valuable, containing a large number of tables on the components of many foods with respect to their content of carbohydrate, protein, fat, vitamins, minerals, and energy values.

Public Administration Organizations. *Edited by Robert N. Paige.* 5th ed. Cloth bound; 167 pages. Public Administration Clearing House, 1313 East 60th Street, Chicago, 1941. $1.50.

This is a directory of voluntary unofficial organizations working in the general field of public administration or in fields that impinge upon and affect public administration. It has been compiled for the use of these organizations themselves, public officials, and students of government, as a guide to sources of information.

The presidents of the two national veterinary associations listed in the directory are Alexander E. Wight (right), president of the American Veterinary Medical Association and Edgar A. Crossman (below), president of the United States Live Stock Sanitary Association



Drs. Wight ('97) and Crossman ('91) are both graduates of the Harvard University School of Veterinary Medicine, which closed its doors 40 years ago. Since the number of living graduates of this institution is now quite small, it is interesting that two of them were chosen to head the two major national veterinary associations during 1941

The book lists 556 national organizations in professional and technical fields which serve as guides to the government. They are the vital organs of our nation, inasmuch as they represent not only the sum of knowledge but also the will and the influence of their respective memberships. Although but quasi-official in character, they occupy a dominating position in public affairs because of what they represent in human thought and achievement. Moreover, their most prominent members and executives are federal, state and municipal officers who obey the doctrines of their societies in the execution of their official duties.

The public administration organizations of the United States are, in effect, the government itself, which marches wisely along under their counsel. Whereas, in other countries such societies are strictly regimented, those of the United States are no less influential in public affairs than in the sciences and arts they voluntarily cultivate, unfettered.

Such societies as the United States Live Stock Sanitary Association and the American Veterinary Medical Association with their federal and state connections, to cite but two examples, largely influence public thought and official action in their fields, which they are free to command without objectionable interference.

The publication of this book is financed by a special grant of funds. The trustees of the Public Administration Clearing House make no appeal for memberships or contributions. They do, however, invoke the officers of these organizations to be more prompt and more earnest in supplying the data required to catalogue correct, up-to-date information on membership, jurisdiction, objectives, directorate, etc., of these important organizations.

* * * *

Taber's Cyclopedic Medical Dictionary. *By Clarence Wilber Taber and Associates.* Imitation leather binding. 1,500 pages. 273 illustrations. F. A. Davis & Company, Philadelphia, 1940. Plain, $2.50; thumb indexed, $3.00.

This dictionary contains between 50,000 and 60,000 medical terms, or nearly as many as unabridged medical dictionaries of larger dimensions. The pages are 4" x 9", printed in 8-point type, with the defined terms in bold face. The vowels are diacritically marked and syllables are accented for pronunciation. Greek, Latin and other derivations are shown. Prefixes and suffixes are defined alphabetically in the text.

The material difference between this and other medical dictionaries is the lengthy treatment of important terms. The diseases, for example, are described in respect to their cause, diagnosis, symptoms, prognosis and treatment, some with graphic illustrations. "Anesthesia," for another example, is allotted two pages, describing local, regional, general, infiltration, spinal anesthesia, etc.,

with an excellent illustration on nerve blocking. For "poison" there is a two-page table of the commoner ones and their antidotes. "Protozoa" are described by means of a table giving 15 genera and twice that many species. Under "thermometer" is a table giving the Fahrenheit and Centigrade equivalents. For the word "bacteria," the classification of the Society of American Bacteriologists is arranged in a table giving order, family tribe and genus, which makes up an abbreviated primer on the subject; and under "skeleton" all the bones of the human body are named and classified. In the appendix are listed all of the muscles, the nerves and the blood vessels.

The vitamin tables conform to modern knowledge on the subject. The section closes with "Definitions of Vitamin Units," which are none too well known nor easy to remember. This tabulation explains Sherman, U.S.P.(A.D.M.A.) and International units with their equivalents.

The table on the 93 elements (with remarks on Nos. 94 and 95) refreshes the mind on valence, atomic weight, specific gravity, etc.—a valuable addendum to such a book.

Inasmuch as the exactitude is vouched for by competent authorities of prominent universities and hospitals of Chicago (Northwestern, Chicago, Loyola, Cook County, Michael Reese, Augustana), and since the author is a lifelong medical lexicographer who knows the penalty of errors, there is no risk in adding this new kind of medical dictionary to one's library. For the desk of those who write, it will be found a jewel—a handy reference whenever the memory defaults. It lives well up to both "cyclopedic" and "dictionary" in the title.

You may obtain any book reviewed in this department by remitting the published price to the Book Department of VETERINARY MEDICINE, 7632 S. Crandon Ave., Chicago, Ill.

Training the Dog. *By Will Judy,* Editor of *Dog World.* 6th ed. Cloth bound; 160 pages, illustrated. Judy Publishing Company, Chicago, 1941. $1.50.

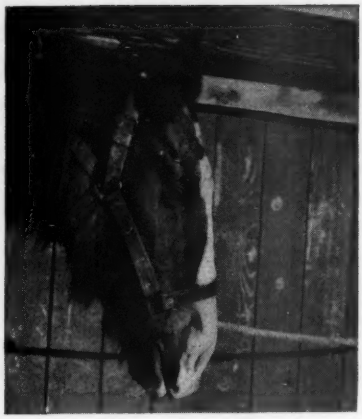
In this sixth edition of his book on the training of dogs, the author gives the good advice needed in the practice of that art in such a way as to instruct the novice, and also to remind the professional trainer about the fine points of canine mentality which serve as the starting point of the training process and furnish the means for cultivating the obedience which distinguishes dogs from other animals.

Much attention is paid to the dog's mind. In fact, eight chapters are devoted to impressing upon the reader that the dog has an extraordinary amount of intelligence apart from the instincts all animals employ in the struggle for existence. Such eulogy is pardonable in writing for lay readers who, not without reason, want the dog raised to exalted heights on the scale of mental differentiation. On the other hand, over-rating a dog's intelligence and thus expecting too much from it can certainly do more harm than good. Both trainer and trainee can suffer in consequence of an overestimated intelligence; the dog is confused and the misinformed trainer disappointed.

The chapters on just what to do to teach a dog to lead, to heel, to watch, to guard, to behave properly in house and street, and to overcome faults and vices, are obviously the kind of lessons experience has taught.

The addenda include "case studies," the official score card for police-dog training, a dog's prayer for his master, the dog's bill of rights, and the rules for obedience test trials now becoming popular in dog-show circles.

Veterinarians are indebted to Will Judy for simplifying the problem of keeping up to date on things canine.



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You'll Be Interested to Know That . . .

Life is more complicated nowadays than it used to be. In the old story about the Naming of the Animals, you will remember how Adam asked Eve (who was helping him in this arduous task) why she had called a certain strange-appearing beast an elephant. "Because it *looks* like an elephant," replied Eve with true feminine logic . . . It isn't that simple now. You can't call a canine disease blacktongue because it looks like blacktongue; it may be leptospirosis (April issue, page 220). You can't call a bovine malady foot-and-mouth disease because it looks like foot-and-mouth disease; it may be vesicular exanthema (see page 240, this issue). . . . You can't even call a creamery product butter because it looks like butter; it may be—well, see the June issue of VETERINARY MEDICINE.

■

"The old order changeth" in Maine, where Mr. H. M. Tucker has retired after nearly 25 years of state service. His place as chief of the Division of Animal Industry has been filled by the appointment of Mr. D. P. Corbett. . . . Working with Mr. Corbett as Consulting Veterinarian for the State Department of Agriculture will be Dr. J. F. Witter, Animal Pathologist at the University of Maine, and secretary-treasurer of the Maine V. M. A. . . . Doctor Witter will retain his position at the University, serving the state on a part-time basis.

■

F. A. Zimmer (Ohio State University '09) has joined the Corn States Serum Company organization, and will represent the company in Ohio. Doctor Zimmer was chief field veterinarian for Ohio 1909-1915, and State Veterinarian 1923-29 and 1935-39. He has been president of the Ohio State Veterinary Medical Association and a member of the executive board of the A. V. M. A. For 16 years he was in general practice in Licking County, O. . . . Doctor Zimmer is evidently a believer in the full life; not content with the fine record he has achieved in private practice, in state and national regulatory work, and in state and national professional societies, he is rounding out his career by a "tour of duty" in the commercial field.

According to the *Allied Veterinarian*, " 'Veterinarian' is said to be the only word in the English language having six syllables, six vowels, and six consonants." . . . How about "humanitarian"? Or does that mean the same thing? There is some debatability here.

■

An unusual dinner party that "made the news" last month was that given by Dr. C. A. Bradley, Marion, Ia., for five friends, each of whom had been a donor of blood to the doctor during a recent serious illness. The Marion Sentinel printed a picture of the affair under the caption, "Venerable Veterinarian Vends Vitality-Venders Victuals." . . . By the way, we don't want to seem to be belaboring the point made in the paragraph just above, but how about "venerability," as a 6-6-6 word, and dilatability and —oh, perhaps a hundred others, *Allied Veterinarian?*

■

Another banquet worthy of mention was that held by the Firelands Horse Association recently, at which Dr. J. H. Fulstow, Norwalk, O., was honored on the occasion of his 80th birthday. . . . At the age of 80 Doctor Fulstow sits a horse like a veteran cavalryman. And he continues to practice his profession with zest and efficiency, even finding time now and again to give the younger fellows the benefit of his experience by contributions to veterinary periodicals (see "Fifty Years' Experience with Acetonemia" on page 656 of the November, 1940, issue of VETERINARY MEDICINE).

■

It has been predicted that the forthcoming eighth annual meeting of the American Animal Hospital Association (April 23-26, at the Hotel Statler, Buffalo) will be the best yet held by this ambitious organization. . . . The program for the meeting is being arranged by a committee of four veteran members: Drs. J. V. Lacroix, Evanston, Ill., Chairman; Joseph B. Engle, Summit, N. J.; Otto Stader, Ardmore, Pa.; and Frank E. McClelland, Buffalo. The latter is in charge of local arrangements. A banquet and a number of sightseeing trips are planned in addition to the scientific program. The clinic, Saturday morning, April 26, will be conducted by Dr. John D. Gadd, Towson, Md.

FREE FOLDER FOR VETERINARIANS .. outlining the treatment of various infections with
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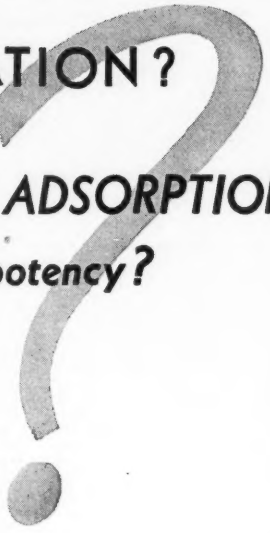
ALUM PRECIPITATION?
or
ALUMINUM HYDROXIDE ADSORPTION
—for greater bacterin potency?



CUTTER research workers found the answer to that problem ten years ago when they were pioneering, with blackleg, the chemical precipitation of bacterial vaccines.

Aluminum hydroxide adsorption is markedly more effective!

We appreciate the compliment of other laboratories belatedly following our lead in the use of aluminum compounds, but wish to point out to our friends in the veterinary profession that the word "alum" is no "open sesame" to bigger and better bacterins.

Purified aluminum hydroxide is selective in its action as it almost completely adsorbs the antigens to the comparative exclusion of other substances present. The antigens remain in the adsorbed state until injected. The various aluminum salts (known as "alum") on the other hand have an inadequate adsorptive effect except in the presence of aluminum hydroxide and even then such adsorption is both nonselective and reversible. As a result, not all of the antigens are adsorbed and those that are may go back into solution.

For bacterins in which the antigens are truly adsorbed, so that the desirable extending effect is assured, insist on "aluminum hydroxide adsorbed."

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Among Cutter's aluminum hydroxide adsorbed vaccines

Blackiegol
Charbonol
Clostridium Hemolyticum Bacterin (Red Water)
Hemseptol
Mixed Bacterin (Bovine) Formula 2 and 3
Streptococcus Bacterin (Equine)
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Pelmenal
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Tetanus Toxoid
Mixed Bacterin (Porcine) Formula 1

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MEAL • PELLETS • PUPPY FOOD
The Complete Foods

Army Veterinary Corps

New Appointment.—Capt. William Edward Bills, Veterinary Corps Reserve, as 1st lieutenant, Veterinary Corps, Regular Army, March 22, 1941. He is assigned to Edgewood Arsenal, Maryland.

Promotions (Temporary).—To Major, March 10: Capts. Arvo T. Thompson, March Field, Calif.; Harvie R. Ellis, Fort Bliss, Tex.; Ralph W. Mohri, Panama Canal Department; Austin T. Getz, Fort Clark, Tex.; Wesley W. Bertz, Philippine Department; Edgerton L. Watson, Indiantown Gap, Pa.; George T. Price, Fort Bragg, N. C.

Transfers.—Col. Jacob E. Behney, from Fort Riley, Kans., to Panama Canal Department, leaving New York May 22; Lt. Col. George L. Caldwell, from Fort Riley, Kans., to the staff and faculty at The Cavalry School, Fort Riley; Lt. Col. Forest L. Holycross, from Fort McClellan, Ala., to Hawaiian Department, leaving Charleston, S. C., June 9; Lt. Col. Claude F. Cox, from Hawaiian Department to Fort McClellan, Ala.; Lt. Col. Allen C. Wight, from Panama Canal Department to Ford Ord, Calif.

Veterinary Corps Reserve

Ordered to Extended Active Duty.—Lt. Col. Paul C. Kucher, to Fort Bliss, Tex.; 1st Lts. Terry Sam Ozier, to Army Medical Center, Washington, D. C.; John W. Taylor, to South Central Remount Area, San Angelo, Tex.; Raymond B. Gochenour, to Langley Field,

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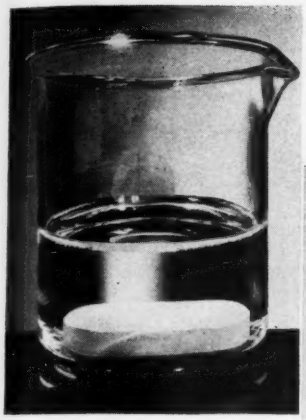
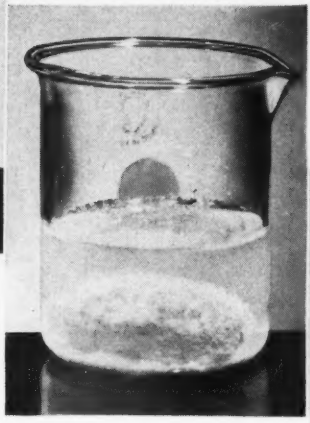


PHENOBOLE at time of placing into water

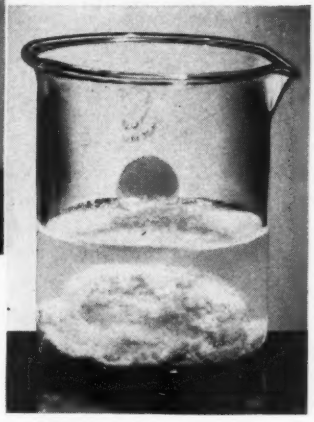
PHENOBOLE

For Quick Disintegration



Twenty seconds later

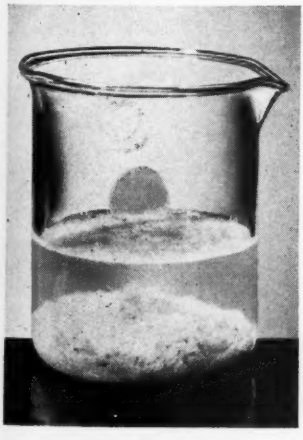
Complete disintegration of our PHENOBOLE in less than two minutes as shown in this graphic demonstration, assures early effective anthelmintic action beginning high in the intestinal tract.



Forty seconds later

PHENOBOLE provides a practical, accurate and effective dosage form of Phenothiazine as an anthelmintic for poultry and farm animals. Its unique shape permits easy administration by hand or with a standard balling gun. No lubricant is necessary.

Complete disintegration in 60 to 90 seconds



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in 1 lb., 5 lb., 10 lb., 25 lb., 100 lb., and 150 lb. containers.

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Va.; William W. McMichael, to McChord Field, Wash.; Benjamin B. Loveland, to New York Port of Embarkation, Brooklyn, N. Y.; Walter R. Anderson, to St. Louis Medical Depot, St. Louis, Mo.; Fred D. Maurer and Donald Kingston Theophilus, to Front Royal Quartermaster Depot, Front Royal, Va.

Promotions.—To Lt. Col. (temporary), Maj. Ray S. Youmans, March 13 and George S. Nechling, March 25; to Major (temporary), Capt. Thomas A. Ward, March 19, and William H. Shannon, March 27; to Captain, 1st Lts. William E. Eggert, Jr., March 18; Sol G. Stephen, March 21; Gerald W. Holmberg, March 24.

Transfers.—Capt. John C. Johnson, from Fort Riley, Kans., to the staff and faculty at the Cavalry School, Fort Riley; Capt. Donald R. Morgan, from Presidio of San Francisco, Calif., to the Philippine Department, July 12; 1st Lt. Hilding M. Marlowe, from Presidio of Monterey, Calif., to Camp San Luis Obispo, Calif., March 5; 1st Lt. Philip R. Carter, from Fort Snelling, Minn., to Army Medical Center, Washington, D. C., March 20; 1st Lt. Ralph A. Maxwell, from Camp Upton, New York, to Pine Camp, New York; 1st Lt. Horace R. Collins, Jr., from South Central Remount Area Headquarters, San Angelo, Tex., to Air Corps Basic Flying School, San Angelo, Tex., April 1; 1st Lt. Benjamin D. Blood, to duty as attending veterinarian, Fort Screven, Ga., in addition to his other duties.

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Waltham, Massachusetts

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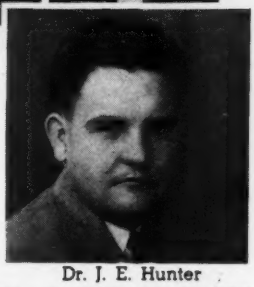
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Now you can feed and recommend Wayne with confidence. Nutritional values are uniformly correct. Guess work has been eliminated—and dog owners profit with better, sleeker dogs. *Send for FREE SAMPLE and complete scientific data...*

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SPECIAL
DAIRMOL DUSTING POWDER
FOR GRANULAR VAGINITIS
Antiseptic Astringent

"THE DAIRMOL WAY"

Compounded under the direction of two veterinarians of exceptional experience.
Highly recommended by leading herdsmen as the best treatment for the purpose.
Extensively used among prominent practitioners.

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The costly azo dye, Biebrich Scarlet Red, with camphor, wintergreen, turpentine, and chloroform in a heavy emollient base, penetrates and stains the udder, leaving the odor of wintergreen throughout the barn.

Compare this product with udder "salves" and it will soon be one of your best dispensing items.

1 Doz. 350cc Bottles.$3.50
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Meat Inspection Course.—The following officers, now on active duty, are ordered to report at the Chicago Quartermaster Depot March 18, 1941, for a 30-day course of instruction in the inspection of meat, meat-food, and dairy products: Lt. Col. Ray S. Youmans, 101st Med. Reg., Camp Edwards, Mass.; Capt. Richard E. Geisler, Fort Douglas, Utah; 1st Lts. John P. Ayres, Fort Hancock, N. J.; Ralph C. Close, Fort Totten, N. Y.; Philip L. Gauntt, Jr., Fort Eustic, Va.; Floyd W. Koebel, Holabird Quartermaster Depot, Md.; Herbert I. Ott, Camp Blanding, Fla.; Mark E. Gale, Camp Claiborne, La.; Elmer L. Matthews, Camp Forrest, Tenn.; Albert Conrad Nagle, Fort Benj. Harrison, Ind.; Louis A. Dehner, Camp Joseph T. Robinson, Ark.; William S. Houk, Fort Riley, Kans.; Burt W. English, Ft. Brown, Tex.; Jack A. King, Fort Clark, Tex.; James R. Ketchersid, Fort Bliss, Tex.; Leonard L. Ogburn, Los Angeles, Calif., Joseph L. Wesley, Elgin Field, Fla.; Russell J. Henshaw, Chanute Field, Ill.

■

Lady Moore, widow of Maj. Gen. Sir John Moore, Director of the Army [British] Veterinary Service during World War I, met her death, together with all other occupants of the building, in a house that was demolished by an enemy bomb near the end of February. General Moore died in February, 1939. He was known to many American veterinarians who served overseas during 1917-18.

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PHARMACEUTICALS

Specialized formulae compounded especially for the needs of the busy practitioner.

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Large stock of well known products.

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Complete line of all Veterinary instruments and sundries.

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Coming Meetings

Massachusetts Veterinary Association, monthly meeting, Hotel Westminster, Boston, Mass., April 23.

American Animal Hospital Association, eighth annual meeting, Hotel Statler, Buffalo, N. Y., April 23-26.

Mississippi Valley Veterinary Medical Association, ninth annual clinic, Armory, Galesburg, Ill., May 22.

■

Deaths of Veterinarians

H. Langevin, Crookston, Minn., McGill University '86, December, 1940.

T. F. Cairns, Forest, Ont., Ontario Veterinary College '06, January 4.

D. E. Bleecker, 56, Columbus, Wis., Chicago Veterinary College '09, January 14.

W. H. Orth, 78, Toronto, Ont., Ontario Veterinary College '92, practiced in Beamsville, Ont., until retiring eight years ago, January 30.

Albert Aime Etienne, 71, Montreal, Que., University of Montreal '90, for eight years president of the College of Veterinary Surgeons of the Province of Quebec, in 1921 and 1927 vice-president of the A. V. M. A., February 8.

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H W & D *is a background of*

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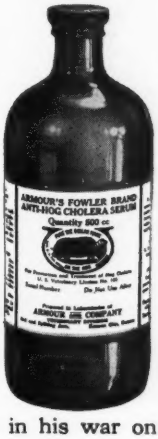

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Armour's "Fowler Brand" Serum is available in 100 cc., 250 cc., and 500 cc. bottles.

Armour's "Fowler Brand" Virus is supplied in 15 cc., 30 cc., 60 cc., and 100 cc. bottles.

Your **Armour "Fowler Brand"** Serum requirements can be easily and quickly filled at most Armour Branch Houses or Creameries; or by Dr. Robt. D. Wall, 910 28th Street, Des Moines; Dr. Robt. J. Hoskins, 3203 East Washington Street, Indianapolis; Mr. A. G. Carter, Findlay, Ohio; Dr. H. W. Brown, 623 West Main Street, Fort Wayne.

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¼ DOZEN
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MONTREAL

Alexander Glass, 81, Beach Haven, N. J., McGill University, February 17. Doctor Glass was emeritus professor of canine pathology in the School of Veterinary Medicine, University of Pennsylvania, where he had taught for many years. He entered general practice in Philadelphia in the early '80's, retiring from practice and from teaching several years ago. In 1896 he translated Mueller's *Diseases of the Dog* from the German, the work going through five editions during the next 30 years.

C. S. Westrick, Craig, Nebr., Kansas City Veterinary College '12, February, 1941.

Joseph D. Houldsworth, 75, Roxborough, Pa., University of Pennsylvania '92, served as city veterinarian in Philadelphia for 18 years, retiring in 1936, February 28.

Stephen W. Hewitt, 78, Elgin, Ill., Michigan State College, practiced in Elgin and St. Charles for 35 years, February 28.

Robert White, 88, St. Paul, Minn., for 25 years chief veterinarian for the St. Paul fire department, March 2.

D. W. Nicholas, 46, Fairmont, Minn., Chicago Veterinary College '16, March 4.

BOOST VITALITY DOG FOODS

Regardless of whether or not you *sell* dog foods, you need not hesitate to *boost Vitality* to your patrons. You can recommend VITALITY DOG FOODS purely on the grounds of outright HIGH QUALITY, with the assurance that every needed nutritional factor is amply provided.

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Dr. Naylor's Medicated Teat Dilators

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Dr. Naylor Dilators fit either large or small teats without overstretching or tearing, are easy to insert and stay IN the teat. They carry antiseptics and healing agents into teat canal to combat infection and promote healing. The dilators themselves are Medicated, Soft, Absorbent dressings which protect the inflamed area, absorb inflammatory exudates and keep teat canal open in its natural shape while tissues heal.

Price to Veterinarians

Dollar Package (contains 48 Dilators).....$8.00 Per Doz.
Fifty Cent Package (contains 18 Dilators)..... 4.00 Per Doz.
←Plain Dispensing Package (contains 15 Dilators)..... 3.00 Per Doz.

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W. J. Scott, 73, Clarkston, Wash., Colorado State College '17, March 7.

P. S. Stearns, 83, O'Brien County, Ia., practiced in O'Brien County 52 years, March 11.

Joseph Scott Gordon, 32, Omaha, Nebr., Iowa State College '30, practiced in Wyoming for four years, in the B. A. I. service at Sioux City, Ia., for four years, then returned to private practice, moving to Omaha in 1940, March 15.

Elmer Budd Fenton, 57, Anamosa, Ia., Chicago Veterinary College '10, March 16. Doctor Fenton practiced in Olin and Stanwood, Ia., until 1924, when he came to Cedar Rapids to establish the Vigortone Company, manufacturing stock feeds, of which he was president at the time of his death.

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5 lb. can	4.75
10 lb. can	9.00
25 lb. can	21.25
100 lb. can	70.00

TABLETS (0.4gm)

500	$ 1.65
1000	3.00
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(These tablets are colored and shaped to resemble grains of yellow corn and are flavored. Chickens pick them up and eat them readily.)

SLIP CAP ROLLS (10 inches long)

1 roll (100gm)	$ 0.55
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- Thiamin chloride, 50 to 55 U.S.P. units
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- Factor W, adequate at 4% of yeast in ration.

This yeast, incorporated to the extent of 5% in a ration deficient in the vitamin B complex, permits rapid growth in rats.

POWDER		TABLETS (7½ grains)	
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5 lb. drum	2.25	1000	1.50
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100 lb. drum	33.00	10,000	10.00

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POWDER

1 lb. can	$ 1.85
5 lb. drum	8.75
10 lb. drum	16.50
25 lb. drum	38.75
2 oz. sifter can, each	.50
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TABLETS (5 grain)

1000	$ 2.25
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(Tablets may be had in white, red, blue and yellow. White tablets sent on unspecified order.)

Write for special quotations on large quantities of tablets or boluses.

ATTRACTIVE PRICES ON MISCELLANEOUS PRODUCTS

Thiamin chloride	gm.	$ 2.00
Ascorbic Acid	oz.	4.00
Nicotinic Acid	lb.	13.50
Sulfathiazole	lb.	13.50
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Dicalcium Phosphate	lb.	.20

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(Prepared and tested according to the requirements of the B.A.I.)

6 5cc vials (with tags and certificates)	$2.25
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